KENYA COLONY AND PROTECTORATE

Department of Agriculture
Annual Report
1933

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Part I.—Administration

ANNUAL REPORT OF THE DIRECTOR OF AGRICULTURE

The principal staff changes are recorded in Part IV of this Report.

Mr. Alex. Holm, Director of Agriculture, left the Colony on the 18th April and retired with effect from the 1st September, and his successor, Mr. H. B. Waters, assumed duty as Director on 24th December. Reference to Mr. Holm's valuable services were made in last year's Report, which was prepared subsequent to his departure.

Mr. H. Wolfe, Deputy Director (Plant Industry), was Acting Director from the 18th April until the 23rd December.

Mr. D. L. Blunt, Assistant to Director, was appointed Director of Agriculture, Cyprus, with effect from 29th August, 1933. Mr. Blunt's position at Head Office brought him into contact with all officers in the Department, who regret his departure, while congratulating him on his promotion.

FINANCIAL.

Statements of expenditure and revenue for the fiscal year under review are given below :—

EXPENDITURE	Amount Originally Sanctioned	Amount Expended
	£	£
"A" ADMINISTRATIVE AND GENERAL—(including total cost of Headquarters Staff) ..	13,260	11,685
Expenses, Board of Agriculture and Committees	1,000	473
Grant to Kenya Agricultural Society	150	150
Contribution to Amani Institute	2,028	2,028
Contributions to Imperial Bureaux of Entomology and Mycology	450	450
Contribution to Imperial Scheme for Agricultural Scholarships	324	324
Contribution to Colonial Agricultural Service	140	140
Contribution to Imperial Agricultural Bureaux	200	200
Contribution to Locust Research	400	384
Expenses in connexion with Locust Destruction	2,000	825

STATEMENT OF EXPENDITURE AND REVENUE FOR THE FISCAL YEAR.—(*Contd.*)

EXPENDITURE	Amount Originally Sanctioned	Amount Expended
"B" DIVISION OF PLANT INDUSTRY	13,065	11,115
Subdivisions—		
Native Agriculture	15,729	13,050
Scott Agricultural Laboratories	11,338	11,143
Plant Breeding Services	3,093	3,111
Grading, Conditioning, etc.	7,372	5,036
"C" DIVISION OF ANIMAL INDUSTRY (Administrative)	8,145	7,628
Subdivisions—		
Veterinary Services (Executive)	17,907	17,031
Animal Husbandry	728	690
Veterinary Research	21,870	21,179
Native Services	19,326	18,304
Expenses in connexion with Rabies Campaign	1,150	1,110
£	139,675	126,053

Not taking into account expenditure on locust destruction and rabies, the expenditure of the Department was £4,150 lower than the net expenditure for 1932.

As shown in the following detailed statement, revenue amounted to £17,412, compared with an estimated sum of £20,525 :—

REVENUE	Original Estimates	Actual Receipts
	£	£
Grading, Conditioning and Cold Storage Fees, etc.	6,500	4,026
Fees from Agricultural Chemical Laboratory..	75	120
Sale of Farm Produce and Stock	900	687
Sale of Stores	50	85
Veterinary Inoculation Fees, etc.	10,000	10,168
Sale of Sera, Vaccines and Laboratory Products	3,000	2,326
TOTAL AGRICULTURAL DEPARTMENT.. £	20,525	17,412

ECONOMIC CONDITIONS DURING THE YEAR.

The general tone of business in the Colony during the year might be described as one of restrained optimism. Though no hopes of rapid improvement in the economic situation were entertained, there was nevertheless a quiet assurance that the bottom of the depression had been passed. The menace of locust swarms receded into the background; overseas prices of several commodities, such as maize, sisal, cotton, wool and hides, registered moderate but steady advances. The progress of gold prospecting opened up visions of possible wealth from which agriculture might derive indirect benefit in the future.

The outlook was darkened, however, by the failure of the long rains. Taking agricultural production as a whole, the Colony came fairly successfully through the ordeal, but its effect was felt severely in the coffee and dairy industries. In certain districts it was found necessary to institute measures of food control.

Efforts continue to be made to broaden the basis of agricultural production in the Colony. The extension of mixed farming in arable areas makes slow progress owing to the acute shortage of capital, but promising strides are being made in the extension of dairy production in native reserves. Pyrethrum culture proceeds apace and a beginning has been made with cashew nuts in the coastal belt. Cotton cultivation is being increased. Government has agreed to the principle of cultivation of Arabica Coffee in native reserves; strict control is to be maintained and the industry confined to an experimental basis until preliminary problems are surmounted.

Towards the end of the year the surcharge which has been imposed by the shipping companies on ocean freight rates was reduced from 15 per cent to 10 per cent. This is a small but welcome reduction of the fixed charges which bear so heavily on commodities whose overseas value has fallen by 50 per cent or more during the depression.

Though the effect of the drought on the yield of the coffee crop did not prove to be as great as was at one time feared, the early promise of a bountiful yield was rendered abortive. It was feared at first that the drought had exerted such an adverse effect on the liquoring quality as to depress prices very considerably, these being on a very low level during the latter part of the year. Since the new year, however, the usual season upward swing has appeared and prices have recovered, suggesting that the low prices in the early part of the season were to some extent due to uncertainty over the crop situation and the presence of old-crop stocks in London. The amount of coffee which changed hands at the low prices, however, was small and the bulk of the crop remained to be disposed of at the better prices which ruled in the new year. At the same time the opportunity was seized to reduce the volume of unsold stocks in London.

A noticeable feature of the Agricultural Census returns is a pronounced drop in the area under maize, the fall being no less than 21 per cent as compared with the preceding season. In part this is no doubt due to the very low prices which were realized for the 1932-33 crop but a contributory cause may be the dry conditions at planting time and during the early part of the growing season.

The effect of the drought on the dairy industry was accentuated by a severe reduction in the price of butter on overseas markets, a reduction which brought in its train a corresponding fall in the value of oilseeds. Not only does the oil compete directly with butter, being used in the margarine trade, but the other joint product, cattle feeding stuffs, depends for its market largely on the dairy industry.

The year is notable for an appreciable advance in three directions, which together may have far-reaching effects on the live stock industry in native reserves. An experiment was carried out in co-operation with the Nairobi Municipal Council, whereby a number of cattle received by the Administration in lieu of tax were converted into fertilizing material and subsidiary products. The information obtained from this experiment has enabled concrete proposals to be framed for attacking the pressing evil of soil deterioration due to overstocking, converting uneconomic surplus live stock into products of economic value, and furnishing valuable fertilizing material from a local source. At the same time it assists in the maintenance of Government revenue without real loss to the natives concerned.

The second departure was a move in the direction of providing an outlet for cream from native reserves through the existing creameries. Previously the only outlet was in the form of ghee for the local market. The value of ghee had fallen to a low point owing partly to pressure of supplies on the very restricted local market, and it was plain that any expansion of the local production would defeat its own object by creating a condition of glut. On the Kenya Co-operative Creamery, Ltd., agreeing to take native-produced cream, supplies were organized from the Nyanza Province and promising strides were made before the end of the year. The initial period was not without its difficulties, as no efficient collecting and transport organization was in existence in the reserve, but there is no reason to doubt that success will be achieved within a reasonable time. The potential output of cream from native reserves is large. Co-operation with local creameries will enable this cream to be converted into a more valuable product than ghee and at the same time will enable the native live stock industry to expand on export markets. The advisability of establishing an additional creamery to deal jointly with this produce of the Kavirondo Reserves and of European farms in the Uasin Gishu and Trans Nzoia was mooted.

Not all localities are so situated that they can be expected to contribute within a reasonable time to fully-equipped creameries. To meet the needs of more inaccessible areas steps have been taken to test the London market for supplies of clarified butter. There is some reason to hope that a market will be found for a fair quantity of this material, and experiments are continuing with a view to finding the best methods of manufacture, packing and transport.

Further progress was achieved in the direction of improvement of the preparation of hides for export. Reference to this subject will be found in the report of the Deputy Director (Animal Industry). Progress was made in egg-marketing and an efficient testing and grading service is now being conducted for European producers by the Kenya Farmers' Association. The potentialities of native reserves have received a measure of attention from members of the commercial community.

MAIZE AND RAIL RATES.

As stated in the last Annual Report, an attempt was made during the 1932–33 season to reduce the cost of railway operation by making monthly tonnage allocations for maize and cotton seed. The object was to ensure that these low value bulk commodities should be moved coastwards without creating a traffic peak. The operation of the scheme proved to be beset with difficulties and in 1933 it was decided to abandon the method of monthly tonnage allocations made in advance, and instead to leave the matter to the Railway authorities to arrange movement under non-peak conditions on a basis of co-operation with the industries concerned.

The monthly quota system necessitated the movement of maize before it was properly dry and with the low prices ruling for maize on overseas markets, the necessity for reconditioning a portion of the maize at the Coast imposed a burden which the industry was ill-equipped to bear. The position was considered by the Board of Agriculture and on its recommendation Government authorized reductions in the local charges. The charges for conditioning were accordingly reduced from 50 cents to 35 cents per bag; for reconditioning of grain rejected by the grader from 60 cents to 45 cents per bag; and for regrading from 5 cents to 1 cent per bag. The reductions were made at the expense of contributions to the redemption fund of the conditioning plant, current operating costs being covered by the reduced charges.

These reductions were applied to exports during the 1932–33 season and were subsequently extended to the 1933–34 season until, after the end of the year, a rise in maize prices rendered it possible without creating undue hardship to impose higher charges.

SUGAR—RATIONALIZATION.

During the year attention was focussed on the problem of ''rationalization'' of the sugar industry. A rapid increase in production in Uganda and the prospect of some increase in Kenya following on the cessation of locust attacks constituted a threat to the stability of the industry. In the depressed state of the world sugar market export from East Africa could only be considered as a last resort. In the absence of some agreement among producers an uneconomic struggle to secure the home market and to escape the burden of export was in prospect. A preliminary step for restriction of production was taken by Kenya, Uganda and Tanganyika Territory in concert, by prohibiting by legislation the importation of new milling machinery except under special authorization. Negotiations between the various mills with regard to voluntary control of output to which the Directors of Agriculture in Kenya and Uganda gave much of their time continued during the year but no finality was reached.

WHEAT IMPORTATION.

It was found necessary to import further quantities of wheat in the grain in 1933. As in 1932 a refund of five-sixths of the basic duty on wheat imported under licence was made to the licensees under the Ordinance, and the suspended duty was removed.

4,000 bags of wheat were imported under licence during the year.

WHEAT POOL.

The Sale of Wheat Agency handled 89,016 bags of wheat from 1932/33 deliveries, together with 3,638 bags carried over from the previous year. In addition, 89,016 bags were imported from overseas and disposed of to mills.

As a result of the operations of the Agency the net returns received by growers for wheat delivered ranged from Sh. 16/90 to Sh. 14/40 per bag, according to grade.

A sum of £239/10/48 being part of the profit made as realization of the 1931/32 overcarry was transferred to the Wheat Equalization Account.

BOARD OF AGRICULTURE.

No changes in the membership of the Board occurred during 1933. The constitution as remodelled in 1932 proved satisfactory for the purpose for which it was designed and no amendments were found necessary. The Board forms a valuable link between agricultural and associated interests, by means of which representations can be made on behalf of the industry to Government and other bodies, as circumstances dictate.

Meetings of the full Board were held on 18th January, 16th June and 15th November; of the Animal Industry Standing Committee on 16th January, 11th August and 14th November; and of the Plant Industry Standing Committee on 17th January and 13th November.

Of matters considered by the Board and Standing Committees the following were the more important: Application of the Fencing and Cattle Cleansing Ordinances; charges on cattle entering Uganda from Kenya; marketing of native live stock and the erection of a factory for disposal of surplus native cattle; overstocking and development of native pastoral areas; extension of the limit of advances by the Land Bank; financial assistance for new agricultural industries in the Colony; enquiry as to the reasons for the apparent deterioration of quality of maize exported and recommendations for improvement in this respect; prevention of and corrective measures for soil erosion; the Noxious Weeds Ordinance; the Butter Levy; and investigation of line of resources in the Nzoia Province.

The cost of the Board during the year, including travelling expenses of and allowances to members of the Board and salary of a stenographer amounted to £475. Assistance in the work of the Board was rendered by the staff of the Department, in addition to their other duties.

COFFEE BOARD.

During the year the newly-constituted Board appointed to deal with problems affecting the coffee industry, made extensive preparations for its future work. A London representative was appointed to carry on investigational and propaganda work on behalf of the industry. The main objects set before the London representative were to study the London market in relation to the sale of Kenya coffee, the possibility of reducing distribution costs and of securing a better return to the producer and the general question of publicity, and to explore new avenues for the sale of Kenya coffee. It was also decided to appoint a bio-chemist with bacteriological training to undertake research work on the problems of fermentation and curing.

Among the various matters dealt with by the Board during the year were consideration of the South African market with a view to securing in the Union a further outlet for Kenya coffee; the question of local sales, storage and handling in Nairobi; preparation of a memorandum on Imperial Preference for coffee for transmission to the Secretary of State for the Colonies; investigation of the financial position of planters; and standardization of grades and types of coffee.

For fuller information regarding the work of the Board reference may be made to the Board's Annual Report for 1933, obtainable from the Secretary.

On the departure of Mr. Alex. Holm in April, 1933, Mr. R. S. Wollen was elected as chairman.

LAND AND AGRICULTURAL BANK.

The operations of the Land and Agricultural Bank of Kenya during the year 1933 are recorded in the Annual Report submitted to His Excellency the Governor. Copies may be had from the Government Printer, Nairobi. Owing to temporary exhaustion of funds, applications were not being considered by the Board during January–May. In June intimation was received that the funds of the Land Bank would be increased by £260,000, bringing the total capital amount up to £500,000, and the consideration of applications was resumed. During the year 239 applications were received for advances aggregating £393,526. Total advances of £175,450 to 141 applicants were approved. The total number of mortgages at December 31st was 258 securing advances of £319,550. Administrative expenses for 1933 amounted to 1.01 per cent of the capital invested and as a result of the year's operations a sum of £2,205 was carried to Reserve Account. A comprehensive scheme of inspections of mortgaged properties has been instituted. The purposes to which advances have been allocated are classified as under :—

	per cent
Discharge of existing mortgages ...	39.3
Permanent improvements	18.7
Purchase of land	18.7
Purchase of stock	11.5
Farming operations	11.0
Purchase of machinery and implements	.8
	100.0

At the beginning of the year legislation was passed which provided for the Bank to act as agents for the Government and on January 1st, 1934, the work of the Agricultural Advances Board was taken over under this amending Ordinance.

ROYAL AGRICULTURAL AND HORTICULTURAL SOCIETY OF KENYA.

The Society organized two agricultural shows during the year, at Nakuru in March, and at Nairobi at the end of December. Full reports of these shows were published in the Press, and it will suffice to state that each show was a great success, apart from the financial standpoint. The Nakuru shaw was followed by a Farmers' Day, organized by the Department of Agriculture and attended by a satisfactory number of the farming community. A special feature of the Nairobi show was a display indicative of development in the Native Reserves. Several Departments of Government co-operated in this section, which gave comprehensive impression of the work undertaken by Government for the betterment of the native's economic resources, and general standard of living.

During the course of the year the Society once more organized a Maize Seed Competition, in co-operation with the Department of Agriculture. A draft Milk Recording Scheme was also published, and whilst it met with a considerable measure of approval in principle, it was severely criticized in certain quarters on the score of the expense involved to the dairy farmer participating therein. An amended scheme is in course of preparation which it is believed will overcome the difficulty of expense.

During the year considerable reorganization has taken place in the clerical work of the East African Stud Book, with a view to giving more efficient service to breeders. The Rules governing the Stud Book have been entirely revised, and a scheme for the identification of pure bred calves by tattooing came into force on January 1st, 1934. The number of entries received for Volume VI of the Stud Book, which closed on December 31st, was greatly in excess of any previous volume.

The Society also published a scheme for an Egg-Laying Trial, but due to the very disappointing number of entries received from poultry breeders, it was subsequently decided to postpone the inauguration of the Trial until 1935.

From the financial standpoint the past year proved very difficult, and the Society is at present engaged in an energetic appeal for a greater measure of financial support from the community, in order that its useful activities may be maintained.

ECONOMICS AND STATISTICS SECTION.

The amalgamation of the sections dealing with agricultural statistics and economics under the direction of the Agricultural Economist was mentioned in the preceding Annual Report. The combined work is now carried on by the Agricultural Economist and one clerk, whereas in former years a statistical officer and one clerk was available for the statistical work alone. The Agricultural Economist was absent from the Department for two months during the past year, acting as secretary to the Alternative Revenue Proposals Committee. It was also found necessary during part of the year to detach the statistical clerk for other work. In consequence only a limited amount of work outside routine matters was possible.

An economic survey of grass dairy farms, begun in 1932, was continued during the year. In all, upwards of fifty farms were visited by the Agricultural Economist in the course of the survey and detailed figures were secured for forty-eight farms. These were tabulated and analysed. The results, with the conclusions arrived at, were compiled in bulletin form. Though compilation of the bulletin was completed by July, pressure of work at the Government Press prevented its issue before the end of the year.

A bulletin describing a simple system of accounts and records for the use of farmers not desiring an elaborate double-entry system was written and will be issued in 1934.

A note upon the market for egg products was prepared and will appear in bulletin form in due course.

A number of notes on various subjects were written during the year and published locally. Among these were :—

Kikuyu and Danish agriculture compared, a statistical study of the output of food material per unit area and per capita in the Kikuyu Reserve as compared with a progressive European peasant country.

India as a market for Kenya Produce.

Prices of Kenya coffee in relation to production, a beginning of a statistical study of the influences affecting the price of Kenya coffee.

The tenure of native land.

Towards the end of the year a tour of the chief arable areas was made with the object of observing economic conditions affecting arable farming and of studying the factors likely to affect the development of mixed farming. Though a certain amount of economic data were gathered the tour was undertaken rather with a view to planning more thorough investigational work at a later stage than to the formulation of conclusions directly.

CROP REPORTS.

The usual crop forecasting services were carried out by the Department. It is desired to acknowledge with thanks the services of those crop correspondents who have submitted returns regularly and promptly. Though early in the season considerable criticism of the accuracy of the coffee crop forecast was made, the final outcome has proved that the estimate based on crop correspondents' returns has been remarkably accurate despite the abnormality of the season.

IMPORTS.

The following table gives particulars of the principal imports of food commodities into Kenya over the last **five** years:—

	1933		1932		1931		1930		1929	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Cwt.	£	*Cwt.*	£	*Cwt.*	£	*Cwt.*	£	*Cwt.*	£
Fruit, Fresh	..	7,016	..	6,047	..	7,841	..	9,706	..	8,747
Fruit, Canned, Dried etc...	3,428	10,721	3,604	13,142	4,146	13,446	4,307	16,800	5,521	21,810
Garlic and Onions ..	19,657	8,335	18,771	9,340	9,163	8,722	20,546	9,649	19,885	9,842
Ghee	7,591	16,512	4,933	13,062	4,675	12,167	5,471	18,160	7,229	30,384
Meat, all kinds ..	3,013	9,757	343	1,773	668	2,767	1,201	4,654	1,470	5,979
Milk, Condensed, Dried, etc. ..	6,713	12,171	6,220	12,894	10,440	21,240	11,632	27,608	11,664	33,631
Rice	123,097	64,609	116,819	69,561	143,933	82,471	166,400	133,933	145,303	131,805
Sugar	2,559	2,389	4,423	4,182	6,360	6,148	34,650	23,510	48,130	38,639
Tea	160	1,422	186	1,654	1,258	10,680	3,012	27,360	6,631	59,986
Wheat	158,150	52,861	104,451	33,700	2,996	1,638	2,742	2,171	2,847	2,530
Wheat Flour	19,630	10,489	30,092	16,902	57,449	31,033	54,259	41,468	58,540	49,872
TOTAL VALUE .. £	..	196,282	..	182,257	..	198,203	..	315,019	..	393,225

It will be seen that the total value showed a considerable decrease until the last year, when a local shortage of wheat was responsible for an increase under this head. The decrease in other items is partly accounted for by lower prices, but steady decreases in quantity have taken place in the case of sugar, tea and wheat flour. Garlic and onions, ghee and rice, all imported mainly from Tanganyika Territory, have for the most part maintained their former volume.

EXPORTS.

The total value of agricultural exports, the produce of Kenya in 1933, was £1,901,929, a decrease of £75,477 from the preceding year. Substantial increases were shown in the cases of maize and maize meal, sisal fibre, sugar, tea, hides and cotton, while decreases occurred in those of coffee, wattle bark and extract, and butter.

The following table shows the exports of the principal commodities over the past five years :—

	1933		1932		1931		1930		1929	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Cwt.	£	*Cwt.*	£	*Cwt.*	£	*Cwt.*	£	*Cwt.*	£
Animals, Living ..	..	2,616	..	4,825	..	5,499	..	8,709	..	10,731
ANIMAL PRODUCE										
Butter	7,514	27,268	9,242	40,604	6,325	35,618	7,798	53,065	2,631	15,126
Hides	91,733	132,103	53,506	87,067	34,848	63,354	46,066	115,112	64,369	263,804
	No.		*No.*		*No.*		*No.*		*No.*	
Skins, Sheep and Goats	960,610	20,496	524,329	16,167	932,285	36,870	1,709,155	66,131	1,502,203	74,052
	Cwt.		*Cwt.*		*Cwt.*		*Cwt.*		*Cwt.*	
Wool	8,330	38,481	8,503	39,293	7,784	43,427	8,335	70,615	9,135	98,872
ther Animal Produce	..	34,118	..	36,185	..	26,848	..	25,292	..	28,415
O CROP PRODUCE										
Coffee	257,214	832,353	276,041	1,214,392	245,991	986,988	310,168	1,427,536	133,234	703,158
Cotton	9,600	23,584	4,032	8,589	2,795	6,588	5,421	17,657	7,104	24,800
Sisal	397,000	249,868	307,700	186,575	319,880	232,564	318,930	437,269	312,954	553,572
Maize and Maize Mea	1,156,473	218,514	520,543	119,133	1,879,824	425,041	2,294,135	586,851	810,876	326,660
Wheat	118	50	1,727	525	63,644	15,313	214,527	91,447	69,603	38,281
Wheat Flour	41,076	25,158	30,221	18,777	28,082	20,263	38,537	33,150	32,013	31,996
Sesame Seed	64,840	36,761	45,400	28,535	9,720	5,347	22,600	15,287	29,690	27,635
Potatoes	51,192	10,704	68,130	15,386	49,723	13,258	45,018	11,138	82,755	27,050
Sugar	82,644	66,963	16,046	17,879	21,709	24,930	15,683	19,899	15,645	25,503
Tea	17,462	76,667	6,252	29,262	3,158	16,795	1,432	8,192	70	738
Wattle Bark and Extract	244,840	66,764	246,354	85,866	198,441	73,231	147,889	63,080	85,119	53,646
Other Crop Produce..	..	39,461	..	28,346	..	31,307	..	59,897	..	84,706
TOTAL VALUE.. £	..	1,901,929	..	1,977,406	..	2,063,241	..	3,110,327	..	2,388,745

NATIVE AGRICULTURE.

The latest data available are the estimates made for the World Agricultural Census of 1930, details of which may be found in the Agricultural Census Report, 1930.

During 1933 conditions in the native reserves were generally unfavourable owing to the drought. Food production in some areas was barely sufficient for the needs of the resident population. Large numbers of live stock perished.

NATIVE AGRICULTURAL EXPORTS.

The estimated value of agricultural exports of native origin for the last five years are shown hereunder. These figures do not include the large amounts of maize and other products which come on to the local market from native reserves :—

	1933	1932	1931	1930	1929
	£	£	£	£	£
Animals	2,300	3,600	5,000	8,600	10,300
Beeswax	4,000	4,000	4,500	2,000	3,000
Copra and coconuts	1,000	500	1,200	2,250	2,500
Cotton	23,600	8,600	6,500	17,200	24,800
Cotton seed ..	300	500	..	5,000	5,400
Groundnuts ..	3,200	1,200	6,000	16,500	29,500
Hides	130,000	86,500	60,000	105,000	220,000
Maize	36,000	12,500	..	75,000	45,000
Millets	300	100	20	2,800	240
Pulse and beans ..	6,000	6,000	6,000	14,000	12,500
Sesame	36,700	28,500	5,000	15,200	27,500
Ghee	7,100	6,700	3,800	4,900	4,500
Skins	20,000	15,700	35,000	73,000	87,000
Oils-various ..	6,000	5,600	3,200	6,700	10,000
Potatoes	8,000	9,300	13,000	10,500	24,000
Miscellaneous ..	5,000		2,000	2,000	2,000
Wattle bark and extract	66,000	4,000 79,500	71,000	42,000	35,000
TOTALS £	355,500	272,800	222,220	402,650	543,240

Notable increases are shown in hides and skins, cotton and maize.

WEATHER CONDITIONS.

The rainfall during 1933 was in most districts well below the average. The long rains largely failed in the area east of the Rift Valley, and the drought had very serious effects on the coffee crop and the live stock industry. In the higher parts of Kiambu sufficient precipitation occurred. In the main cereal areas the rains, though late in arrival, were sufficient to allow of the recovery of crops. The relatively low rainfall favoured the production of wheat.

STATISTICS OF DEVELOPMENT.

European Areas.

As statistical data of native agricultural development are not available the statistics which follow apply only to agricultural development by Europeans.

The total area allotted for occupation by Europeans is approximately 7,525,120 acres, of which about 981,760 acres are available for alienation. Of the alienated area, 5,138,324 acres are under occupation, the area having decreased by 67,940 acres from the preceding year. The number of European occupiers total 2,027, a net decrease of 75 from the preceding year. The number of Europeans employed on agricultural holdings decreased by 425 to 2,364 during the past year.

The total area under cultivation as at February 28th, 1934, was 556,182, a decrease of 37,806 acres. Making allowance for the area used for live stock it is estimated that the area beneficially occupied was on the average 1,410 acres, as against 1,367 acres in the preceding year. Appreciable areas in addition are used by native squatters and employees.

The following table shows the relation between area occupied, area under cultivation and area cropped : —

YEAR	Total Occupied Area	Total Cultivated Area	Total Area under Arable Crops during the Year	Total Area Cultivated but not Cropped during the Year	Percentage Cultivated to Occupied Land as at 28th February	Percentage Cropped to Cultivated Land	Percentage Fallow
	Acres	*Acres*	*Acres*	*Acres*	*Per cent*	*Per cent*	*Per cent*
As at 28th February—							
1934	5,138,324	556,182	478,512	77,670	10·82	86·00	14·00
1933	5,206,264	593,988	510,762	83,226	11·41	85·98	14·01
1932	5,199,093	613,557	519,387	94,170	11·80	84·65	15·35
1931	5,315,483	650,965	572,339	78,626	12·25	87·92	12·08
As on 31st July—							
1930	5,111,161	643,644	564,145	79,499	12·59	87·65	12·35
1929	5,000,648	635,590	570,171	65,419	11·40	89·69	10·31
1928	4,896,406	592,741	525,421	67,320	11·81	88·64	11·36

Indian Agriculture.

A general census of agriculture carried on by Indians has not been taken for the year 1933–34. It has, however, through the courtesy of the Nyanza Indian Farmers' Association, been made possible to give the following figures relating to the activities of the Indian farming community in the Kibos–Miwani area :—

Total number of Indian landowners as at February 28th, 1934	55
Total area occupied by Indian landowners	10,935

MAIN CROPS.

This section deals with European areas, except for wattle bark, potatoes and cotton.

The total area under arable crops during 1933–34 was 478,512 acres, a decrease of 32,250 acres from the preceding year. Areas under the main crops during the last two years are shown in the following table :—

	1933–34 acres	1932-33 acres	Increase per cent	Decrease per cent
Maize	112,949	164,018	..	31·1
Wheat	35,001	30,114	16·2	..
Barley	4,435	3,025	46·6	..
Coffee	102,238	100,387	1·8	..
Sisal	141,495	139,834	1·2	..
Tea	12,471	12,034	3·6	..
Coco-nuts	8,346	7,839	6·5	..
Sugar Cane	12,704	12,088	5·1	..
Wattle	17,788	14,613	21·7	..
Essential oil plants	1,949	1,953	..	·2

Maize.

The following table shows the acreages and yields of maize during the last five years.

MAIZE AREAS, TOTAL YIELD AND AVERAGE YIELD PER ACRE OVER A PERIOD OF 5 YEARS

YEAR	Acreage Harvested	Total Yield	Average Bags per Acre
1929–30	233,973	1,858,586	7·94
1930–31	200,926	1,649,728	8·21
1931–32	160,546	762,622	4·75
1932–33	164,018	1,139,616	6·94
1933–34	112,949	746,893	6·62

1932–33 *crop.*—The quantity exported showed an appreciable increase over the quantity exported from the preceding year's crop both in the grain and as meal, the quantities exported in 1933 were respectively 1,131,549 cwt. and 24,924 cwt., as compared with 514,917 cwt. and 5,626 cwt. in 1932.

1933–34 *crop.*—Both area and yield showed a considerable reduction, due partly to unfavourable weather during the planting season and partly to the low average price received for the preceding season's crop. The average yield was 6.62 bags per acre, as compared with 6.94 for the season before.

Sisal.

The output of sisal fibre further increased and reached the record level of 20,127 tons. The total area under sisal increased to 141,495 acres, from 139,835 acres in the preceding year. The area under three years declined, however, and it is evident that little new planting is being carried out.

Exports of fibre during 1933 amounted to 19,850 tons valued at £249,868.

Wheat.

Reference has been made in a preceding section to the necessity of importing further quantities of wheat during 1933.

The area of wheat harvested in the 1933–34 season increased by 4,887 acres to 35,001 acres. With the relatively high yield of 4.16 bags per acre the total production amounted to 145,581 bags, which should leave a small surplus above milling requirements.

YEAR	Acreage Harvested	Total Production
	Acres	*Bags*
1928–29	82,951	223,141
1929–30	63,217	293,468
1930–31	68,851	194,337
1931–32	43,168	86,362
1932–33	30,114	63,493
1933–34	35,001	145,581

The quantity of wheat milled in the Colony increased to 128,974 bags, from 121,906 bags in the preceding year. The quantity of fine flour produced was 45,392 bags and that of atta and meal 51,881 bags. Twenty mills were engaged in wheat milling during the year.

Barley.

The area of barley harvested during the year increased to 4,435 acres, from 3,025 acres in 1932–33. The total production increased to 22,824 bags from 15,845 bags in the preceding year.

Coffee.

The area planted with coffee continues to increase, the acreage as at February 28th, 1934, being recorded as 102,238, an increase of 1,851 acres on the year.

The early promise of the 1933–34 crop was for a record yield, but drought conditions supervened in April, May and June and heavy losses of crop were sustained. The losses were not as great as was at one time feared would be the case, but the crop year closed with a total production of 235,009 cwt. of clean coffee, which is far below what might have been expected under average climatic conditions.

Exports during 1933 amounted to 257,214 cwt., valued at £832,353, as compared with 276,041 cwt. valued at £1,214,392 in 1932. The value of coffee represented was 43.7 per cwt. of the total value of agricultural exports in 1933.

Monthly average prices actually realized on the London market during the last four years were as follows :—

	SHILLINGS PER CWT.			
	1933	1932	1931	1930
	Sh.	*Sh.*	*Sh.*	*Sh.*
January	73	108	79	111
February	67	106	82	101
March	62	93	78	83
April	57	75	73	73
May	56	66	65	69
June	59	58	56	63
July	57	60	55	58
August	55	64	52	66
September	57	68	57	72
October	55	75	74	80
November..	62	72	80	79
December	58	71	93	75
Year	64	85	74	77

The decline in average prices which had set in during the last two months of 1932 continued during the year under review and the final average for the year reached the lowest point on record.

During the early months of the year top prices were well below those realized in the corresponding months of the preceding year, but towards the end of the year the condition was reversed and fine quality parcels were selling at higher prices than in the corresponding period of 1932.

Tea.

The tea industry made further rapid progress during the year. The area planted increased by 437 acres to 12,471 acres and the production of prepared tea by 642,631 lb. to 3,063,687 lb.

Exports of tea amounted to 17,462 cwt. valued at £76,667, as compared with 6,252 cwt. valued at £29,262 in 1932.

Sugar.

After the decline in area in the two previous years, the area during the year showed an increase from 12,088 acres to 12,704 acres. The production of crystallized sugar increased to 112,980 cwt. from 106,320 cwt. in 1932–33.

Exports of sugar during 1933 reached a total of 82,644 cwt. valued at £66,963.

For the first time statistics of sugar transferred from Uganda to Kenya were compiled. The total amount so transferred in 1933 was 69,097 cwt.

Wattle Bark.

The value of wattle bark and extract exported during the year declined to £66,764 from £85,866 in 1932. This decrease is due entirely to a decrease in market values and the total quantity in terms of dry bark shows an appreciable increase. A noteworthy feature of the year is the reappearance of wattle extract in quantity in the export returns. The quantities exported during recent years have been as follows :—

	Wattle Bark	Wattle Extract
	Cwt.	*Cwt.*
1933 ..	216,081	28,759
1932 ..	236,545	9,809
1931 ..	192,368	6,073
1930 ..	131,160	16,729
1929 ..	63,342	21,777

Essential Oils.

Exports of essential oils during 1933 amounted to 3,739 gallons, valued at £8,777, a slight decrease from the figures of the previous year.

Cotton.

Despite the drought which adversely affected planting in the Coast Province the output of seed cotton reached 8,305,601 lb. during the season under review. Of this 6,856,382 lb. was produced in the Nyanza Province and 1,449,219 lb. in the Coast Province. The total quantity of lint ginned was 2,700,001 lb. as compared with 1,710,773 lb. in 1932–33 and 694,183 lb. in 1931–32.

Live Stock.

The following table shows the numbers of live stock owned by Europeans during the last five years :—

	*1930	†1931	†1932	†1933	†1934
Cattle—Total	226,861	236,895	248,279	259,188	256,167
(*a*) Breeding Stock ..	129,311	135,530	147,095	152,594	151,953
(*b*) Other Cattle .	97,550	101,365	101,184	106,594	104,214
Horses	2,265	2,263	2,196	2,346	2,299
Mules	548	492	442	428	343
Donkeys	1,225	951	974	1,047	1,051
Sheep (wool-bearing) ..	207,237	218,845	202,456	203,372	223,176
Sheep (native)	23,708	27,507	32,751	36,134	24,074
Goats	2,840	2,972	2,312	2,441	2,847
Pigs —					
(*a*) Breeding sows ..	2,738	2,691	2,449	2,704	2,502
(*b*) All others	14,632	12,539	11,261	11,927	12,471
Poultry	44,844	49,183	62,629	57,037	48,931

* As at 31st July.
† As at 28th February.

Cattle.

The total number of cattle in the possession of Europeans as at 28th February, 1934, for the first time for a number of years, showed a decrease from the preceding year's figures. The decrease is to be ascribed to the abnormally heavy mortality and to decreases in the number of work oxen and of bull calves. The decrease in bull calves may in itself be a good sign, as indicating a move away from the semi-ranching method of dairying. TThe numbers of breeding stock as a whole were maintained, while the number of heifer calves shows an increase.

Sheep.

The number of wool-bearing sheep showed an increase of 28,804 over the preceding year. The production of wool reached a total of 931,330 lb., which is little short of the previous record for the Colony.

The number of native sheep on European holdings declined.

Pigs.

The number of breeding sows declined slightly while that of other pigs showed an increase.

Poultry.

The number of poultry decreased, but the output of eggs increased to 100,103 dozen from 88,785 dozen in the preceding year.

Animal Products.

The following is a comparative table of the animal products sold by Europeans during the last five years :—

	Milk (Whole)	Cream	Butter fat.	Butter	Cheese	Ghee	Wool	Eggs
	gal.	*gal.*	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*	*doz.*
1933–34	939,434	85,678	754,808	307,349	140,633	35,708	931,330	100,103
1932–33	1,138,743	73,387	923,042	350,405	155,525	47,110	721,542	88,785
1931–32	1,018,868	77,063	675,910	285,320	111,582	96,471	813,662	..
1930–31	1,101,704	145,796	614,790	312,694	131,168	114,527	654,846	..
*1929–30	1,027,375	287,657	(*a*)	371,675	108,875	116,117	893,258	..
*1928–29	791,452	212,914	(*a*)	290,905	145,609	5,215	939,619	..

* In respect of the period 1st August to 31st July.

(*a*) Included in cream.

Decreases are shown in the production of all classes of dairy produce.

Statistics of dairy commodities produced by local creameries are shown below :—

YEAR	Total quantity of milk received from Farmers	Quantity of butterfat received from Farmers	Products manufactured therefrom		
			Butter	Cheese	Ghee
	Gallons	*Lb.*	*Lb.*	*Lb.*	*Lb.*
1933–34..	237,180	1,118,656	1,235,019	124,922	55,822
1932–33..	183,754	1,243,356	1,428,471	92,938	29,404
1931–32..	167,043	864,516	1,069,043	69,728	19,416
1930–31..	118,688	1,083,877	1,207,295	79,247	55,958

LABOUR.

The average number of native labourers employed on European holdings during the past five years is shown below :—

Year	Men	Women	Children	Casual daily labour	Total
1933 ..	81,883	3,536	14,771	6,685	106,875
1932 ..	79,749	3,506	14,610	7,160	105,025
1931 ..	76,604	3,260	15,330	5,926	104,120
1930 ..	89,856	3,387	19,393	7,574	120,210
1929 ..	90,633	3,971	18,124	13,157	125,885

A slight increase occurred in the returns of employment during the year.

PUBLICATIONS

In addition to the publications given under the sections dealing with Plant and Animal Industries, the following were published :—

Annual Report of the Department of Agriculture, 1932.

Agricultural Census, 14th Annual Report, 1933.

Crop Reports—January, February and July–December, 1933.

AGRICULTURAL LEGISLATION

The following legislation affecting agricultural industries was promulgated during the year :—

ORDINANCES

Agricultural Advances (Amendment) Ordinance, 1933.

Butter Levy (Amendment) Ordinance, 1933.

Coffee Industry (Amendment) Ordinance, 1933.

Land and Agricultural Bank (Amendment) Ordinance, 1933.

Sale of Wheat (Amendment) Ordinance, 1933.

Stock and Produce Theft (Levy of Fines) Ordinance, 1933.

RULES AND ORDERS

Under the Agricultural Produce Export Ordinance (*Cap.* 98 *of the Revised Edition*)—

The Grading of Maize (Amendment) Rules, 1933.

The Agricultural Produce Export (Potato) (Amendment) Rules, 1933.

The Agricultural Produce Export (Potato) (Amendment) (No. 2) Rules, 1933.

Under the Cotton Tax Ordinance (*Cap.* 60 *of the Revised Edition*)—

Order varying the Schedule to the Ordinance.

Under the Crop Production and Live Stock Ordinance, 1926—

- The Cashew Nut Marketing Rules, 1933.
- The Pyrethrum Rules, 1933.
- The Wattle Bark Marketing (Amendment) Rules, 1933.
- The Wattle Bark Marketing (Amendment) (No. 2) Rules, 1933.
- Notice regarding Areas in which Wattle Bark may be purchased or sold.
- The Wattle Bark (Marketing) Rules, 1933; (incorporating previous Rules).
- Fees Leviable under Rule 13 (1) of the above.

Under the Customs Management Ordinance, 1926—

- Order Prohibiting the Importation of Crushing and Milling Machinery or Plant used in the Manufacture of Sugar.

Under the Customs Tariff Ordinance, 1930—

- Proclamation Removing the Suspended Duty on Wheat in the Grain.
- Proclamation Imposing a Suspended Duty on Ghee Substitutes.

Under the Diseases of Animals Ordinance (*Cap.* 157 *of the Revised Edition*).

- The Diseases of Animals (Amendment) Rules, 1933.
- The Diseases of Animals (Amendment) (Nos. 2, 3 and 4) Rules, 1933.
- The Diseases of Animals (Prevention of Rabies) (Revocation) Rules, 1933.
- The Diseases of Animals (Poultry) Rules, 1933.
- Rules regarding the Movement of Cattle to and from East Coast Fever Areas.

Under the Stock and Produce Theft (Levy of Fines) Ordinance, 1933.

- Proclamation Extending Sections 10 and 11 to various Districts.

Under the Suppression of Rabies Ordinance, 1933.

- Suppression of Rabies (Fees) Rules, 1933.

OTHER LEGISLATIVE MEASURES.

Further legislation directed to the improvement of produce was enacted during the year. By the Wattle Marketing Rules, the Director of Agriculture was empowered to prescribe dates between which bark may not be removed from particular districts except after inspection. It was made compulsory to sell bark in strips not less than two feet in length, instead of in the chopped state as was formerly done.

The Cashew Nut Rules provided for the restriction of trading in this commodity to persons or firms duly licensed by the Director of Agriculture and the latter was given power to restrict the number of licences granted. These provisions are intended to regulate the trade on sound lines, having regard to the fact that cashew nuts are a quality product, and at the same time to attract the necessary capital for handling and merchandising by protecting it for a limited period from the dangers of destructive competition.

The importation of pyrethrum seed was also placed under the control of the Department. Steps are being taken to develop the culture of a strain of pyrethrum having a high degree of toxicity and none but tested strains will be allowed to be imported. Pyrethrum growers have combined into an association which is already accomplishing useful work.

H. B. WATERS,
Director of Agriculture.

Part II —Plant Industry

REPORT OF THE DEPUTY DIRECTOR (Plant Industry)

ADMINISTRATION.

The Deputy Director acted as Director for eight months during the year upon the retirement of Mr. Alex Holm and Mr. G. J. L. Burton, Senior Plant Breeder and Experimentalist, was appointed to the post of Acting Deputy Director.

The technical services of the Division fall under three heads :—

(*a*) specialist services;

(*b*) agricultural services in European areas;

(*c*) agricultural services in native areas.

The full reports of the specialist services are published independently in this report; the agricultural services in European areas are engaged primarily in field investigational work and a co-ordinated report on this, including the related specialist work, has been prepared by Mr. Burton as part of my present report; the reports on services in the native reserves, concerned primarily with development in a direct way, but not omitting experimental work, are now dealt with under the provincial organization of native agricultural services introduced in 1932. The whole of the investigational and field work of the Division is covered in these reports.

An exception is the investigational work on coffee berry disease. The report on this has been published as a separate bulletin and will be sent to those interested, on request. The Department maintains a small temporary coffee station in Sotik for these investigations.

The Scott Agricultural Laboratories, Kabete, and the Plant Breeding Station, Njoro, headquarters of specialist staffs, serve also as experimental stations for their areas; no separate account is given of their work as this falls under the co-ordinated report of experimental work and the independent reports of the specialist services. In this connection it might be said that the increasing need for investigational work, with pests and diseases particularly, has necessitated the use of the plant inspectors for full-time work on these problems, assisting the specialist staff, as being more urgent than the work of plant inspection at the present time.

These combined services have now assumed a wide scope; they deal with practical problems directed to attain a sounder basis of farming. Much preliminary work in this direction has been done in past years and now that the staff of the Department has been strengthened by the inclusion of a number of agricultural officers trained under the Colonial Agricultural Scholarship Scheme, it is possible to say that substantial progress is being made. A statement of this kind requires corroboration by results. The results will be patent to those who study carefully the reports which follow and to those farmers, now increasing in number, who keep in close touch with the Division's work for their particular activities. It is a matter of gratification to be able to say that the staff enjoys the confidence of the farming community and of the administration. Some of these results may be specified :—

(*a*) *Plant introductions of economic importance* successfully proved in various areas.—Pyrethrum; essential oil plants; grasses; leguminous fodder crops; green manure and cover crops; maize for dry areas; tepary beans for dry areas; salt-bush and karoo-bushes for dry areas; improved sugar-cane varieties; marrowfat peas; millets; sorghums, various fruits.

(*b*) *Establishment of new export products*, through plant introduction, organized supply of plant material and the work of the specialist staff.—Pyrethrum (now an independent organized industry); essential oils; Madagascar butter beans. Others await recovery in commodity prices.

(*c*) *Improvement of existing crops* by breeding and selection.— Wheat; maize (Muratha); maize (flat white); sorghum; bulrush millet; eleusine; pyrethrum; beans. (Work with other crops is in progress.)

(*d*) *Improvement in quality of native export crops* by inspection services.—Wattle bark; maize; sesame; groundnuts.

(*e*) *Increased production of native export crops*.—Cotton (production trebled in three years); wattle bark.

(*f*) *Increased acre-yields of export crops* resulting from investigations.—Coffee; maize; wheat; potatoes.

(*g*) *Increased prices for native export crops* resulting from market organization.—Wattle bark.

The value of the work for major crops has to some extent been masked by the depression, the locust invasion and the drought; to a much larger extent this is the case with minor crops. Progress with these crops will be revealed, in greater degree, with the removal of these temporary adverse factors. The results of the investigational work with coffee, wheat and maize particularly, but with certain minor crops as well, have given many farmers greater confidence in growing these crops.

Mention must also be made in particular of the experiments in the Molo district for the establishment of a farming system which will embrace sheep and dairy cattle with arable farming, the latter for preserving the wheat-growing against the present threat of diseases, by including it in a rotation with temporary pasture of grasses and leguminous fodder crops. These experiments are already sufficiently advanced to give a badly-needed guide to a sound system of farming over a wide area comprising Molo, Mau Summit, Elburgon, Timboroa, Kipkabus, Upper Gilgil and Thomson's Falls.

Much attention has been given to export industries during the year by way of assistance for organization; the following may be mentioned particularly: coffee, sugar, pyrethrum.

The Coffee Board works in close association with this Division. The substantive Deputy Director is vice-chairman of the Board and a member of its executive. As the Board handles substantial funds, careful and close attention to the duties of the position are required. The Senior Coffee Officer is also a member of the Board.

Protracted efforts for voluntary rationalization of the sugar industry of Kenya and Uganda having failed, legislation for compulsory rationalization is in prospect.

The pyrethrum industry is rapidly completing its organization through the Pyrethrum Growers' Association which has appointed a single selling agent. The folly of remaining outside the Association is becoming apparent to the independents and this may obviate the necessity for compulsory legislation. Without sale through a single channel the only alternative to compulsion is the provision of Government machinery for inspection and grading if quality of exports is to be maintained. Kenya pyrethrum is of higher toxic quality than any other coming on the British market; legislation exists for prevention of importation of seed of inferior strains, but inferior methods of preparation may reduce the quality of exports.

AGRICULTURAL SERVICES.

European Areas.

Considerable specialist work for European (as well as native) agriculture is done by the scientific staff stationed at the Scott Agricultural Laboratories and the Plant Breeding and Experiment Station, Njoro. Apart from this specialist work, the Agricultural Officers at both these stations (Mr. S. Gillett at the former and Mr. N. Spranger at the latter) devote a good deal of their time to field experimental work for European agriculture and the two Agricultural Officers stationed in the Rift Valley Province (one, Mr. C. Maher, with headquarters in the Trans Nzoia District, and the other, Mr. R. J. Benstead, with headquarters in the Nakuru District) cover a wide area, by means of co-operative experiments with farmers, for attacking local problems and for improvement of crop production. All these officers constantly give advisory services to farmers as well.

A large part of this section of the report will cover the investigational and field experimental work of these Agricultural Officers, but part of it will also give a brief account of the work of the specialist sections in its application to crops and a variety of problems usually connected with European agriculture both in and outside the Rift Valley Province. The detailed account of the specialist work will appear in the reports by the heads of these sections, that is, the Entomological, Mycological, Chemical, Plant Breeding and Coffee Sections, at the end of my report.

The new Rift Valley Province, stretching from the Kedong Valley, near Nairobi, to Mount Elgon on the borders of Uganda, contains the major portion of the alienated land suited to arable and mixed farming.

As explained in last year's report, the two Agricultural Officers for the province are so stationed and the experimental plots on which they work are so situated that the results of their investigations cover large areas of the Colony, ranging in altitude from 6,000 ft. to 9,500 ft., and in climate graduating from hot, dry districts to those with a cool and moist climate, where climatic conditions exist approximating to those found in Western Europe, except for the lack of a definite dormant winter period and very much shorter summer daylight hours. General agricultural services for those areas east of the Rift Valley of varying altitude but wtih only two short rainy seasons in the year, such as Machakos, Kiambu-Ruiru and West Kenya, are mostly centred at the Scott Laboratories. The special coffee services are centred at Nairobi, but are to be transferred to the Scott Laboratories in 1934.

Cropping conditions during the year in the Rift Valley Province.

This account of cropping conditions during the year is confined to the Rift Valley Province, purely for the present purpose of discussing the Division's field work in that Province. An account of the conditions in the coffee areas will be found in the Senior Coffee Officer's report.

Rongai–Nakuru Area, 6,000 *ft. altitude.*

Crops in general, including maize and wheat, gave very poor yields in this district in 1933 as the rains were very light and badly distributed. In fact a very severe drought was experienced. Several crops showed marked drought resistance, notably groundnuts, Madagascar butter beans, and linseed (variety Bull Moose). Madagascar butter beans were grown on a largely increased acreage and their value has been proved as a drought-resistant cash crop.

Njoro Area, 7,000 *ft. altitude.*—Climatic conditions were nearly as disastrous in this district as at Rongai.

Molo–Mau Summit–Kipkabus, 8,000 *ft. to* 9,500 *ft. altitude.*—The year 1933 was an extremely favourable one for the wheat-growers of the district, yields of up to thirteen bags per acre being harvested. Little damage was done by rust and the wheat generally was of good quality. Yields of oats were also satisfactory.

The acreage under pyrethrum was extended considerably at Molo during the year, and yields in excess of one-half ton per acre per annum are anticipated from plantations in the higher parts of the district. The only drawback to the more extensive cultivation of the crop at present is the difficulty experienced in the drying of the flowers. Investigations with artificial driers are in progress.

A small acreage of linseed was grown in the Molo district, but yields from existing varieties have not exceeded four bags per acre. It is probable, however, that much higher yields could be obtained with the varieties recently issued by the Department.

Dairying and mixed farming generally are gaining favour at Molo, there being a tendency towards the use of higher grade stock.

Trans-Nzoia District, 6,000 ft. to 7,000 ft. altitude.—The past year has been characterized by a long drought and a total rainfall in most of the district of only thirty inches, the usual rainfall is about forty-eight inches. However, despite the lateness of the planting season, yields of maize were, on the whole, high and good district yields were obtained.

Coffee is increasingly popular in the district and fairly extensive plantings took place during the year; still greater acreages would have been planted but for the lack of rain.

There are signs that the standard of cultivation is improving and greater use is being made of green manures, grass mulches and cover crops. Deep and clean cultivation is still too much employed in the coffee on many plantations.

It is evident that, with the increasing acreage of coffee in the Trans Nzoia, greater importance must be attached to experiments on coffee in order to provide a basis for recommendations on coffee culture in a large district which has its own peculiar climatic and cultural problems.

The district is showing a much greater interest in dairying, as part of a mixed farming system. The proposed creamery at Eldoret would do much to accelerate progress in this direction.

After two seasons disastrous in respect of locust attacks and a progressive fall in world prices for maize, increased attention is being paid by farmers to the possibilities of alternative export crops which have been proved locally by the Department and to mixed farming on a dairying basis with maize as a cash crop.

INVESTIGATIONAL AND EXPERIMENTAL WORK.

The experimental and investigational work in European areas has now assumed a wide scope and the Agricultural Officers were chiefly engaged with experiments which may be classified under three main heads. These are:—

(1) Experiments designed to improve soil fertility either by green-manuring or rotation of crops, or by the introduction of a suitable system of mixed crops and stock farming.

(2) Trials of a number of possible new cash crops, fodder and forage crops, green-manure and cover crops.

(3) Investigations into the improvement of certain special crops such as coffee, maize, wheat.

Much of the investigational work in the Rift Valley Province is done on private farms as it is not possible to maintain the number of Government experiment stations required for Kenya where each district varies so much in conditions from every other. Whilst it would be much more satisfactory for such work, especially that of a long range nature, to be done on Government plots, the present practice at least permits of Agricultural Officers keeping in touch with certain farmers and their problems and the Department has been fortunate in finding farmers willing to give up land and some time to helping in the work. The farmers concerned were :—

Rongai : Mr. Wolryche Whitmore.
Molo : Capt. Soames and Mr. Pell Smith.
Trans Nzoia : Mr. J. F. Gilson, Mr. L. A. Elmer, Mr. Cardale Luck, and Messrs. Barnes' Bros.

These farmers do most of the work themselves under the advice of the Agricultural Officer.

Important experimental work is also done at the Plant Breeding Station, Njoro, and a start has been made on a Government plot near Kitale. Four hundred acres of Crown land near the township in the centre of the Trans Nzoia district were selected and secured for the future in case funds are ever made available for the establishment of an Experimental Farm. The site selected is on soil of a sandy type and is typical of the large areas of non-volcanic soil in the Trans Nzoia. Some work in connection with coffee, pasture improvement and forage crop trials was begun on the plot during the year.

EXPERIMENTS ON IMPROVEMENT OF SOIL FERTILITY AND FARMING SYSTEMS.

Climatic and soil conditions in the Rongai, Njoro, Molo and Trans Nzoia districts differ so widely from each other, with different problems and different methods of solution for similar problems, that work done in one district has no great bearing on the needs of another. This applies particularly to investigational work with crops. Though the maintenance of dairy herds in conjunction with arable farming by the provision of rotations including mixed legume and grass pastures should probably be the ultimate aim in all districts and thus most advantageously maintain the fertility of the soil and the prosperity of the farmer, it is clear that the speed with which this system comes into force will vary with conditions in every district and with the money at each farmer's command, so that experiments have still to be conducted into methods of improving the soil by means of green-manuring and fertilizing cereal crops.

The first section of this part of the report consists therefore of a progress report on the green-manuring experiments begun some years ago in the lower altitude districts where conditions are not very favourable for the rapid substitution of a mixed farming system for the one-crop farming system, still in vogue; the second section gives an account of the work in progress to show the facility with which a change over to mixed farming can be made, by the use of temporary grass and clover leys, at the higher altitudes (7,500 ft. to 9,000 ft.) where such leys readily establish themselves and where stock-raising is already a feature of the farming system.

Green-manuring experiments.

It is beginning to be realized from previous experiments how important it is, in all systems of green-manuring, to keep the land covered as long as possible throughout the year with a crop and to plough green-manures in as late as possible so that nitrogen compounds have not been leached out of the soil before the succeeding cereal crop can make use of them. The difficulty of carrying out the proper system is enhanced in Kenya by two factors. The first is the paucity of implements possessed by most farmers compared with the amount of land under the plough, so that ploughing usually has to be extended over a period of at least two months. The second is the difficulty of finding a green manure crop which will tide over the long dry period of December to March which immediately precedes the normal cereal planting season. This difficulty is greater at Rongai and Njoro than in the Trans Nzoia as the dry period is longer and drier but the extensive trials of various green manure crops made during the past few years have given valuable information as to which are likely to prove most suitable for the purpose.

The most important cereal crops in the Nakuru and Rongai districts are maize (with wheat as a side-line), at Njoro maize and wheat, at Molo and all high altitudes wheat is the principal cereal grown with oats and barley occupying minor places, and in the Trans Nzoia maize alone. The green manure crop used in the permanent green manure latin squares at Rongai was cowpeas, and at Njoro and in the Trans Nzoia the crop used was *njahi* (*Dolichos lablab*). More effective green-manure crops will be substituted for these as experience dictates, since a large number of species of these crops are undergoing rigorous tests of their comparative value in other experiments. Full accounts of past trials of possible green manure crops will be found in Bulletins Nos. 3 and 7 of 1932, and No. 2 of 1933.

Rongai.

Experiment I.

Drought interfered with all the experiments but, as in previous years, the figures obtained from the five-sided latin square in which some of the plots are green-manured each year, gave no indication that there was any improvement due to the inclusion of green-manuring, under the system tried.

It is proposed to use Madagascar butter beans as the green manure crop in 1934, as the failure of the experiment to date may be due to the fact that the cowpeas, two crops of which have been used, have not a sufficient bulk and the success of a planting in the short rains hitherto is always problematical under Rongai conditions. It is felt that a long-term green manure crop such as Madagascar butter beans would be on the land longer and there would be less loss of nitrogen between ploughing under and planting time.

Experiment II.

This experiment is intended to make a definite and statistical test of the comparative effectiveness of those green manures which previous observations by eye have indicated as being most likely to give good results. The method adopted is to determine their actual effect on a succeeding crop of maize and the experiment was laid out in the form of a randomized block with four replications of each treatment, comprising forty-four plots of 1/40th acre each. Owing to the unfavourable season experienced in 1933 it was not considered these crops made sufficiently good growth to warrant the next step of planting the maize being undertaken in 1934.

From observation, however, the most successful crops seemed likely to be Madagascar butter beans, sunflower, *njahi* (*Dolichos lablab*) and New Zealand grass pea, and these will be included in a modified repeat experiment commencing in 1934.

Experiment III.—Interplanting of maize with green-manure crops.

Owing to the protracted drought, nothing was learnt from this experiment at Rongai, as the green manure crops made no growth and it is doubtful if this method of green manuring will ever prove successful under the somewhat dry conditions in this area.

Two crops were used for this purpose, these being Madagascar butter beans and rice bean, the latter proving to be the more drought resistant. It was hoped that the Madagascar butter bean would establish itself in the maize and make good growth during the short rains, after the maize had been harvested, but owing to the failure of the rains these hopes did not materialize.

Experiment IV.—To test practicability of different methods of using Madagascar butter beans as a green-manure crop and the effect on the succeeding crop.

Two large plots of Madagascar butter beans were planted on May 13th, 1933, one being cut back and the haulms allowed to lie on the ground as a mulch while the other was left as a straight green manure crop and was ploughed under when ready.

The mulching was carried out when the crop had been planted for six months and by the end of the year it had made further satisfactory growth.

A yield at the rate of four bags per acre of marketable beans was harvested from the unmulched plot, prior to turning under. In practice, it should be possible to harvest a crop of beans and plough in an appreciable amount of green matter in one season.

The maize grown on these plots in 1934 should give an indication as to whether or not there is any residual manurial value from either or both of these treatments.

Njoro.

Drought interfered with many of the experiments here.

Experiment I.

This five-sided green manure latin square was all sown to wheat. The germination was good but the entire crop failed owing to drought and was re-sown on the 28th June.

The second seeding was successful whilst subsequent rains favoured the growth of the crop. Observations were made throughout the growing period but no marked difference between treatment and controls was noticeable.

The plots were harvested on the 19th November, all borders being removed beforehand. There was no significant difference between treatments and controls.

The controls have been drilled to wheat for five successive years. The treated plots were green-manured in 1930 and again in 1932, but subsequent yields have failed to give results.

The high yield of nine bags to the acre, harvested this year, is an indication that the land is in a high state of fertility.

The question of green manuring at the Plant Breeding Station has therefore been discussed at length with all officers engaged on experimental work and the conclusion arrived at is that it is not profitable to continue work of this nature at this station.

A similar experiment in which the plots had been limed as well as green-manured was undertaken but the results after harvest gave no marked difference in yield. The experiment will not be continued as the Soil Chemist at whose request it was laid down agreed that the land was fertile and would not respond to such treatment until many more years of wheat-growing had elapsed.

Experiment II.

A randomized block, containing forty plots each 12 yards by 10 yards was laid down to test the value of (*a*) different green manures grown once in the year as compared to (*b*) different green manures grown twice and turned under twice during the same year on the same plot.

The different green manure crops under (*a*) varied in time taken to mature so the planting date of each was so arranged that all should be ready to turn under at the same time. The latter operation, however, was somewhat interfered with by drought and differences in the time of turning the crops under did occur.

Where two green manures were successively planted and ploughed in on one plot the second planting was made to conform to the above system.

The following green manures were tried: *Njahi*; soya bean; New Zealand grass pea; vetch; lentil; barley; and also *njahi* twice, pea twice and soya bean twice. The crops were turned under in December and early January but in the case of plots receiving two green manures the *njahi* and soya beans were first turned under on the 24th July, replanted on the 17th August and the second crop turned under on the 22nd December; the pea crop was first turned under on the 16th October, replanted on the 11th November and again turned under on the 15th January, 1934.

The first crop of *njahi*, soya beans and peas to be turned under was very poor as the crops were badly droughted and made little or no growth. The bulk of green matter turned under and the percentages of air-dry matter of the green crops grown were taken and noted.

The whole plot will be planted to a cereal in 1934.

Experiment III.

A randomized block of thirty-six plots, each 12 yards by 10 yards, was designed to test (*a*) the best time to turn under a green manure, (*b*) the possibility of taking a cash crop off and then applying the green manure, (*c*) turning a green manure under first, then following with a cash crop and (*d*) the effect of applying two green manures in one season.

(*a*) The green manures were planted in July, August, September, October and November. These were turned under when the crops were ready.

(*b*) The cash crop, lentils, was planted on the 5th June, harvested on the 23rd October, then followed with New Zealand grass pea as the green manure.

(*c*) These plots were planted to New Zealand grass pea on the 5th June, the crop was turned under on the 9th September. The cash crop, Canadian wonder bean, was planted on the 26th October.

(*d*) New Zealand grass pea was sown on these plots on the 5th June and turned under on the 16th October. The second green manure was planted on the 16th November.

The bulk of green matter turned under as well as the percentages of air-dry matter was noted.

This plot also is to be planted to a cereal in 1934.

Trans Nzoia.

The green-manure experiments gave more encouraging results in the Trans Nzoia than at Rongai as the soil both needs such treatment and the climate conduces more to the success of the system.

Experiment I.

The permanent green manure latin squares were in their third rotation on three of the farms. The plot on Gilson's showed no increase, in this third year after green-manuring, over the control plots which had never been green-manured; there was a non-significant increase of 2.11 bags per acre (12.34 bags as compared with 10.23 bags per acre) on the latin square at Elmer's farm and a similarly non-significant superiority of 19.5 bags per acre as compared with 19.06 on the control plots at Sabwani Estate (on lava soil).

The latin square on Barnes Bros.' farm was in its fifth year. The control plots gave 15.22 bags per acre and the plots which had been green-manured the previous year gave a statistically significant increase of 4.06 bags per acre. The plots which had been green-manured two years and four years before gave 17.11 and 15.74 bags per acre respectively, these increases not being statistically significant.

The green manure and phosphate trial plots described in Bulletin No. 3 of 1933 were replanted with maize at Gilson's and Barnes Bros. in 1933, but no results were obtained, which were statistically significant.

A similar latin square, but with the addition of a phosphate fertilizer, was green-manured and fertilized in 1931 at Gilson's and Barnes Bros.' This was planted to maize in 1932 and again this year. The yields in 1933 (two years after green-manuring) given by the green-manured and control plots showed again that the green-manuring had no effect after the first year. It appears that in the Trans Nzoia green-manuring has a slight but definite effect the first year, but in the second year the green manured plots are little if at all better than those which have never been green-manured. It is questionable whether green-manuring every other year would be an economic practice but further investigations with different green manures and different systems of green-manuring will be made.

A similar experiment, but using lime as the fertilizer, was in progress on Elmer's farm. No increase in yield of maize had been recorded in 1931 from a five-sided latin square in which dressings of 0, 1, 2, 3, and 4 tons per acre of agricultural limestone alone had been applied. Sunflowers and field peas, however, were drilled-in on April 13th and 14th, 1932, and ploughed under on June 28th, when the sunflowers were four or five feet high. Lupins were then planted on July 27th. These were left on the land throughout the dry season and were finally ploughed under, when they were quite dry, on May 5th, 1933. Maize was planted on May 15th of this year and yielded an average of 21.81 bags per acre over the whole plot.

No significant difference in yields was shown between any of the green manured and limed plots receiving dressings varying from one to four tons per acre, nor did these green manured and limed plots give significantly greater yields than the green manured but unlimed control. It is clear therefore that, as well as lime alone having no effect, lime in addition to green manuring was no better than green manuring alone. This was somewhat contrary to expectations particularly as previous experiments have shown that green manures which have been phosphated have given better results on a succeeding maize crop in the Trans Nzoia than have green manures which have not been phosphated.

In the experiment under review the yields were extremely good throughout and it is probable that the soil was too good for lime to show any effect. The experiment will be repeated on poorer land to see whether lime is a suitable agent in helping in restoring really worn out lands.

Experiment II.—Interplanting maize with green manures.

The experiments at Sabwani Estate and at Barnes Bros.' farm which had the object of examining the possibility of interplanting widely-spaced rows of maize with green manures were failures at both centres owing to the lateness of the maize season and the inadequacy of the later rains to support the growth of the green manure crops. However, the yields of the maize itself were remarkable; at Sabwani Estate the maize planted in rows 6 ft. apart and 7 ins. in the row gave 21 bags per acre and at Barnes Bros.', where the maize was 9 ins. apart in the row, 19.20 bags per acre.

Experiment to establish dairying with cereal farming. Establishment of temporary grass and clover leys.

This work was undertaken both at Njoro (7,100 ft.) and Molo (9,300 ft.). The experiments at Njoro will only be briefly mentioned but those at Molo will be discussed at some length since it is to the really high altitude districts that this system of farming is likely to prove eminently adapted.

Njoro.

A second attempt was made this year, at the Plant Breeding Station, to establish temporary leys with wheat as a nurse crop. Grasses were not used but the following legumes were tried :—

Lespedeza striata.—Hubam, subterranean, broad red, mammoth red and Tennessee disease-resistant clovers. One strip of wheat was sown at the normal rate of 70 lb. and the other at 40 lb. to the acre. In both strips *Lespedeza striata* and the Hubam and Tennessee clovers were a complete failure. In the 70 lb. per acre strip the subterranean, broad red and mammoth red clovers established themselves, the two latter being by far the best. It is problematical whether the rather dry conditions at Njoro are suitable for this type of agriculture and it will remain to be seen in 1934 whether the established clovers will survive through the dry period of December to March.

Molo (9,300 ft.).

Owing to an increasing tendency towards the development of stock with arable farming in the Molo district, some experiments were begun in 1932 and continued in 1933 to explore fully the possibilities of establishing temporary leys and semi-permanent pastures with exotic grasses and clovers at altitudes ranging from 8,000 to 10,000 feet, since it was anticipated that this exotic type of ley might be successful at these altitudes where the climate is somewhat European in type. Taking a broad view of the future, this was perhaps the most important side of the experimental work done at Molo other than the wheat breeding. If these leys can easily be established in wheat a rotation of paramount importance can be evolved without losing a year whilst the leys are becoming established.

Such leys serve several useful purposes in that they improve the soil, provide useful grazing for stock, whilst they give the land a rest from wheat and do more than anything else to eradicate the serious disease of Take-All of wheat which is becoming a menace in some places. It is clear that the farming system which should be adopted at the higher altitudes is one of dairying, making use of temporary leys varying in duration, with wheat serving as a cash crop in rotation between the leys. It was shown during the year that most of the grasses tried and all the clovers, with the exception of those which are strictly annuals, can be established with wheat as a nurse crop with no adverse effect on the wheat itself, and that the species of grass and clovers used for leys under English conditions are in the main suitable for the same purposes at Molo. It was found that ryegrass need not be sown at more than five pounds to the acre.

The report on this experiment is divided into four parts :—

(*a*) That dealing with grasses and clovers planted separately in 1932 and without wheat as a nurse crop;

(*b*) that dealing with grasses and clovers planted separately in 1933, half of each plot having wheat as a nurse crop and half being planted without wheat;

(*c*) that dealing with grass and clover mixtures planted in 1933, half of each plot having wheat as a nurse crop and half being planted without wheat;

(*d*) that dealing with the establishment of pure grass or clover plots in a standing wheat crop coupled with the effect on them of wheat sown at 60 lb. and at 30 lb. to the acre. The former is the more normal rate of sowing.

(*a*) *Grasses and Clovers planted in* 1932.

(1) Cocksfoot (*Dactylis glomerata*).—After cutting this grass made excellent growth and by September 9th had reached a height of two feet and was flowering heavily. Viable seed was harvested at the latter end of September and about 1½ tons of hay per acre was produced.

(2) Timothy (*Phleum pratense*).—Contrary to expectations this grass grew steadily through the dry period of 1932–33, and went ahead rapidly with the advent of the rains. Flowering commenced on October 20th but was spasmodic, and seed was produced in very small quantities only. The yield of a hay crop would be about 1 to 1½ tons per acre of good quality material.

(3) Italian Ryegrass (*Lolium italicum*).—This grass was outstanding by virtue of the bulk and luxuriance of growth which was made following the rains. It had reached a height of two feet by the beginning of September and flowered very heavily during the months of October and November. Seed production for local demand and possibly export should be quite practicable. By the end of the year no signs of dying out could be observed and it is likely that this grass would prove to be more persistent under Molo conditions than those obtaining in Europe.

(4) Perennial Ryegrass (*Lolium perenne*).—Growth of this grass was not so heavy nor so luxuriant as that of Italian ryegrass, but a much higher percentage of leaf was formed and it should thus be a more valuable ingredient of a mixture.

For seed production it was fairly prolific and there is no doubt that good quality seed could be obtained under Molo conditions. This appears to be the most valuable of the exotic grasses under trial, for grazing purposes.

(5) Danish Meadow Fescue (*Festuca elatior*, subsp. *pratensis*).—This grass compares favourably with Italian Ryegrass both for bulk and quality of hay production. Seed set very freely and would be easy to collect. Under Molo conditions, it is essentially a hay grass and withstands drought to a marked degree.

(6) Chewing's Fescue (*Festuca rubra* var. *fallax*).—This grass grew well throughout the dry periods and maintained a good green colour. It could only be considered valuable for grazing purposes under poor land conditions and the quality is poor.

(7) Hard Fescue (*Festuca ovina* var. *duriuscula*).—This would be a valuable grass as a constituent of a seeds mixture for permanent pasture purposes. It proved to be extremely drought resistant, and set seed freely, but is essentially a bottom grass and would have no value for hay production.

(8) Crested Dogstail (*Cynosurus cristatus*).—This grass failed to survive the dry period experienced in the early part of the year.

(9) Rough-stalked Meadow Grass (*Poa trivialis*).—Like Crested Dogstail, this grass died out during the dry period.

(10) Red Clover var. Tennessee disease-resistant (*Trifolium medium*).—Growth was good through the year and the plants survived the drought without loss. Seed production was poor, approximately 100 lb. per acre. Hay yield was approximately 1 ton per acre.

(11) Mammoth Red Clover (*Trifolium pratense*).—This variety was not so good as the Tennessee disease-resistant strain, either from the point of view of general appearance or bulk of hay produced.

(12) Alsike Clover (*Trifolium hybridum*).—The performance of this clover was disappointing but further trials are being carried out.

(13) Dutch White Clover (*Trifolium repens*).—Growth on the whole was very poor but the clover might prove to be useful as a bottom clover in a medium term ley mixture; drought resistance was marked.

(14) Subterranean Clover (*Trifolium subterraneum*).—The promise shown by this clover in 1932 was not borne out in 1933, although a good stand of plants was obtained by the self-seeding of the 1932 crop. Growth was poor and the plot had a generally unthrifty appearance throughout the growing season.

(15) Hubam Clover or Annual Sweet Clover (*Melilotus alba* var. *annua*).—This crop was the result of the self-seeding of the 1932 crop; the stand obtained was all that could be desired and the growth was excellent. The crop commenced to flower by the early part of December. Slight damage was done to the growing points by frost in December but not enough to affect the crop to any appreciable extent. This crop should prove a valuable one for dairy farmers, once cattle can be induced to eat it. Owing to the freedom with which it sets a seed, its cultivation as a volunteer crop should not be expensive.

(16) Sweet Clover or Biennial Sweet Clover (*Melilotus alba*).—Several strains of Sweet Clover were tried but none of them gave such good results as the annual variety. The variety "Arctis" was the heaviest yielder having a greater percentage of bottom growth than Hubam Clover.

(17) *Melilotus officinalis*.—This species of melilot has yellow flowers which distinguish it from *M. alba*. The performance under Molo conditions of this crop is on a part with that of the white-flowered species. Of the three strains under trial, the one known as Albotrea was the only one to make satisfactory growth.

(18) Birdsfoot Trefoil (*Lotus corniculatus*).—This should prove to be an exceedingly valuable plant to include in the short term ley mixtures, owing to the rapidity with which it covers the ground and the way in which a stand is obtained by volunteering in the second year.

(*b*) *Grasses and Clovers planted in* 1933.

All grasses and clovers were sown broadcast on July 13th and 14th and the plots were all six yards long and one yard wide, half of each plot being sown with wheat on the same date.

(1) Cocksfoot.—Three strains of Cocksfoot were planted, these originating from new New Zealand. Two of these strains were from seed from natural pastures, known as Mother Seed, and the other from pastures which had been laid down with this seed in New Zealand. In the early stages of growth

the Mother Seed plots were not so vigorous as those planted with Permanent Pasture Seed, but by the end of the year there were no visible differences in the growth, except that the former appeared to give a closer and more leafy type of growth and sward.

Growth was excellent on the three plots and a very desirable non-tufty turf was formed. This can be attributed to the high rate of seeding which was employed, namely 20 lb. per acre. The remaining section which was planted under the wheat crop made less growth than where no nurse crop was used, but the wheat did not appear to be adversely affected. It is anticipated that the grass will make good growth when the wheat has been harvested.

(2) Perennial Ryegrass from New Zealand.—Nine strains of this grass were sown, two at the rate of 20 lb. per acre and the remaining seven at 30 lb. per acre. In connection with the seed rates employed, it was apparent that from the time the seed germinated the lower seed rate was adequate. It is believed in fact that this could be reduced to 5 to 10 lb. per acre and a good stand would still be obtained.

Five of the plots were established from mother seed strains, and four from permanent pasture seed strains. The latter made quicker growth in the early stages of the year, but by the end of the year any differences in the plots were so slight that it was impossible to judge them by observation.

Perennial ryegrass under Molo conditions forms a dense bottom growth and is more suitable for inclusion in a pasture which is to be grazed for a number of years than for a short-time ley.

The growth of the grass which was shaded by the wheat was inferior to that on the other half of the plot, but the plants were only droughted and should improve when the wheat is removed. The wheat did not suffer from the competition of the grass.

(3) Brown Top (*Agrostis tenuis*) from New Zealand.—This grass, which is used on the poorer soils of New Zealand, was not successful in these trials. Growth on the unshaded plot was very poor and inferior to that of any other grass tried, whilst the grass on the half-plot shaded by the wheat died out completely during the dry spell in December.

(4) Broad Red, or Red Clover.—This clover was sown at the rate of 12 lb. per acre, germinated well and by the end of the year has covered the ground to a depth of two inches.

The clover under the wheat suffered slightly but not to the same extent as the grasses. There is a sufficiently good stand to give promise of an excellent crop in the second year.

(5) Crimson Clover (*Trifolium incarnatum*).—Germination of this species of clover was very poor but the plants grew extremely well and it should prove to be a valuable hay crop or could be used for folding. As it is only an annual, the experiment will be carried a stage further by attempting to obtain a stand in 1934 from any volunteer plants which may grow in the long rains. Owing to its annual habit, crimson clover would have to be sown without a nurse crop.

(6) New Zealand Wild White Clover (*Trifolium repens*).—Five strains of this species were sown broadcast, three of these being natural pastures (mother seed) and two from permanent pasture. Germination was poor throughout and growth extremely slow at the start, but by the end of the year there was a fair cover on the ground on the portion of the plots which had been sown without a nurse crop. The half of the plot which had been planted with wheat had an adequate stand of clover but the plants suffered from the competition of the wheat.

This plant may form a valuable constituent of permanent pasture, but is too slow and small for temporary ley purposes.

The plots established from mother seed were generally healthier and more robust than those from the permanent pasture seed.

(7) Shaftal Clover (*Trifolium resupinatum*).—This clover was extremely slow in its initial growth but made good progress later in the year, on the half of the plot where it was not covered by the nurse crop. It would not be practicable to sow with wheat owing to the fact that it appears to be an annual.

(8) Montgomery late-flowering Red Clover (*Trifolium pratense*).—Germination of this clover was good, but growth was extremely slow. The plants withstood shading much better than those of other species and a good crop is anticipated in the second year.

(9) *Berseem Clover*.—Four strains of Berseem clover were planted, the seed having been obtained from Egypt. Contrary to expectations, growth was fairly good under the cool Molo conditions, but the plants were badly affected by frost in December; owing to this fact it is doubtful if this crop will be worth growing at Molo.

(*c*) *Grass and Clover Mixtures.*

These trials were laid down with little or no previous knowledge of methods of sowing or seed-rates which should be employed under the conditions prevalent at Molo. Seed rates were based on those used in England for the same purpose and results obtained showed that English practice would not be satisfactory at Molo. This is due to the extremely vigorous growth of the grass constituents of the mixture and the consequent smothering effect on the clovers. The following ley mixtures were laid down; weights are given in lb. per acre:—

(1)	Italian Ryegrass	12 lb.
	Broad Red Clover	8 lb.

One-year ley for hay.

Growth was extremely vigorous, particularly that of the Italian ryegrass. The clover was very much smothered but after moving made good progress.

(2)	Italian Ryegrass	8 lb.
	Perennial Ryegrass	4 lb.
	Broad Red Clover	4 lb.
	Alsike Clover	2 lb.
	Crimson Clover	2 lb.

Two- or three-year ley. Mown in the first year and grazed in subsequent years.

As in the case of No. 1, the grasses were sown too thickly and the clovers had no chance to get away. After cutting, the Broad Red clover started to grow well, but the Alsike and Crimson clover (as might be expected) had failed to withstand the smothering effect of the grasses.

(3)	Italian Ryegrass	8 lb.
	Perennial Ryegrass	12 lb.
	Montgomery Red Clover	4 lb.

Two-year ley, mown in first year, grazed in second.

In this mixture the Montgomery Red clover proved more persistent than the Broad Red used in the other two mixtures and competed well with the grasses.

(4)	Perenial Ryegrass	5 lb.
	Timothy	8 lb.
	Broad Red Clover	8 lb.

Two-year ley.

This proved to be the most successful mixture tried, the clover competing successfully with the grasses, neither of which are so vigorous in the initial stages as Italian ryegrass.

Three other seeds mixtures were tried, but in each case the grasses, particularly the Italian ryegrass, choked out the clovers used.

In future experiments it is proposed to reduce considerably the proportion of grass seeds in the mixtures in order to give the clovers a more favourable start.

From observations made on these plots, it would appear that an adequate stand of both Italian and Perennial ryegrasses can be obtained by sowing at not more than 15 lb. per acre.

In all cases, the clovers and grasses made better growth when planted alone, than when wheat was used as a nurse crop.

(*d*) Further observation plots, eight in number, were laid down to test (*a*) the possibility of establishing pure stands of grasses and clovers in the standing wheat crop, and (*b*) the effect of the stand of wheat obtained by sowing 60 lb. per acre and at 30 lb. per acre. The following were used as undercrops :—

1. Hubam clover, at 20 lb. per acre.
2. Subterranean clover at 5 lb. per acre.
3. Tennessee disease-resistant clover, at 15 lb. per acre.
4. Italian ryegrass, at 4 lb. per acre.

In the case of number 4, one treatment was sown at the rate of 40 lb. per acre for purposes of comparison only. Hubam clover was poor and spindly and it would appear advisable to sow it without a nurse crop. Subterranean clover at this seed rate gave an adequate stand but growth was very poor. Tennessee disease-resistant clover gave a poor germination, probably due to the fact that the seed used had not been scarified; the plants which did germinate, however, made excellent growth and were firmly established by the end of the year.

Italian ryegrass.—In the early stages of growth, the plot sown at the rate of 40 lb. per acre was outstanding, but by December that sown at 4 lb. had completely covered the ground, thus indicating that it is unnecessary to sow at more than 4 to 5 lb. per acre.

Throughout this series of plots, the seed rate employed for the wheat made no appreciable difference to the crop growing in it. In the case of Italian ryegrass, the plot sown at 40 lb. per acre had a markedly adverse effect on the wheat, whereas on all the other plots the wheat crop was all that could be desired.

To summarize the investigational work on grasses, clovers and mixtures, it would seem that :—

(*a*) the majority of the grasses tried and all the clovers with the exception of those which are strictly annuals, can be established with wheat as a nurse crop, with no adverse effect on the wheat itself;

(*b*) seed rates for the grasses employed in 1933 were too high and a figure of 5 lb. per acre can be regarded as sufficiently high for both species of ryegrass;

(*c*) the species of grasses and clovers used for leys under English conditions are in the main eminently suitable for the same purposes at Molo.

Some other Forage Crops at Molo.

Rye.—Two varieties of rye were grown in observation plots; these were Steel and Star imported from Sweden. Growth was slow and a dense mat of foliage was formed before the crop commenced to flower. From a grazing point of view the crop was an ideal one. The amount of seed formed was exceptionally small and thus may be a drawback to its use, unless this factor is improved with acclimatization.

Oats.—Two varieties of oats were planted, England and Biffen's oat, which has been grown at Njoro for several years. The former would be suitable as a forage crop, being of a very robust type. Grain yield was low and the bushel weight was only 29 lb. owing to severe attacks of both crown and stem rust.

Biffen's oat is more of a cereal crop type and was free from both forms of rust, the grain being of better quality and bushelling slightly more.

Fodder Crops.

In view of the interest farmers are beginning to display in the role which dairy herds should play in the farming system, the following report on some further fodder crop trials, made in 1933, should be of interest.

Vetches.

Rongai.—Eight varieties of vetches were grown in small observation plots. The first three named below were the only ones which gave results justifying a further trial. They withstood the drought to a marked degree. The remaining five were either a complete failure or made very poor growth. The varieties were :—

Purple Vetch (*Vicia atropurpurea*)	Poor
Pearl Vetch (*V. sativa*)	
Single-flowered Vetch (*V. monantha*)	

Njoro.—Five varieties were grown and were seeded at a rate of 50 lb. to the acre. All made excellent growth and formed a heavy dense cover. Purple Vetch came away rather more quickly than the rest and is a tall grower, reaching a height of 4 feet. Oregon Common is also an upright grower but only grew to a height of 2 feet. These two vetches made rather a course-textured hay.

The three remaining vetches have a procumbent habit of growth, are more leafy, and make a very fine-textured hay. Below is a table giving particulars as to green matter, air-dry matter and yields of hay in tons per acre.

	Green Matter in Tons per Acre	Percentage of Dry Matter	Tons of Hay per Acre
	Tons	*Per cent*	*Tons*
Purple Vetch	10·33	29	2·99
Woollypod Vetch ..	14·26	19·3	2·75
Hairy Vetch	12·15	23·3	2·83
Oregon Common Vetch	8·2	28·5	2·42

Smooth vetch was very much later than the rest and as only a small quantity of seed was available for planting, no green weights were taken.

Molo.—The vetch plots at Molo were a volunteer crop on the plots planted in 1932. There was an adequate stand on all plots and to show how easily they can be established on grazing lands, it is interesting to note that seed of varieties Woolly Pod and Purple, when carried by surface water into the Kikuyu grass borders, made excellent growth.

The following are comments on the most successful varieties :—

(1) Purple Vetch—excellent growth, set seed well, woody type for hay.

(2) Woolly Pod Vetch—heavy growth, better hay type, shy seeder.

(3) Pearl Vetch—good growth, not so good as (1) and (2), prolific seeder, more suitable as folding crop.

(4) Hairy Vetch—fairly heavy growth, only moderately prolific, third choice for hay.

Varieties Monantha, Hungarian, Oregon Common and Smooth Vetch made only very indifferent growth and are not considered as being worth further trial.

A particularly valuable characteristic of the vetches is the ease with which a volunteer crop can be obtained in the second year, under Molo conditions, particularly in view of the fact that seed is difficult to harvest. It is, however, necessary to cut or fold the crop at a later date than would be considered to be good farming practice, as the crop has to be left until such time as the lower pods have set.

Trans Nzoia.—Several varieties were also grown here. They did quite well but the best were :—

Hairy Vetch.
Purple Vetch.

Lucerne.

Rongai.—The variety Tagerim was planted on July 10th and by the end of the year was fourteen inches high and flowering heavily.

Molo.—Small observation plots of seven varieties of lucerne were planted on July 14th and by the end of the period under review had all made satisfactory progress.

The variety Hairy Peruvian was outstandingly good, and Tagerim occupied an intermediate position between it and the other varieties which were all quite successfully established.

These were :—

Montana Common.
Turkestan.
Cossack.
Hardigan.
Kansas Common.

Cossack lucerne appears to be composed of mixed types, several of which are very desirable and it is proposed to select these in the coming year.

Horse Beans (*Vicia faba*).—Four strains of horse, or tick beans, introduced from Egypt, were planted for observation. Yields were very low but one strain, namely Ribaya 7, was definitely more promising that the others, giving a yield of 4½ bags per acre. Trials with acclimatized seed may indicate that one or more of these strains is likely to be of value.

Njoro and Trans Nzoia.

Trials of Tagerim lucerne and a wild lucerne-like plant (*Stylosanthes mucronata*) were begun at Njoro and of Hairy Peruvian and Provence lucerne in the Trans Nzoia.

Peas.—It will be seen from previous reports and bulletins that a large number of varieties of field peas were tried in past years in several districts to test their value as green manures and certain definite recommendations were made. This year those which showed up best at Rongai were tested for their value as fodder crops. Two of the marrowfats were also tried.

The peas tried were:—

P.B.I.P. 49.
P.B.I.P. 50.
Kaiser.
Dun No. 72.
Lincolnshire Blue.
English Blue.

The growth of all varieties was very heavy and no appreciable difference was observed in the bulk obtained, which was in the region of two tons of dry matter per acre. Dun No. 72 gave a seed yield of 4½ bags per acre. P.B.I.P. 50 was grown for multiplication and gave a seed yield of 6¼ bags per acre, proving itself the best variety for production of peas for cattle food.

Kudzu Vine.—This is showing considerable promise at some of the lower parts of the Highlands as a fodder crop and planting material is being distributed.

Pasture Crops.—The work in progress on forage crops in the special Molo area, special because of its altitude and climatic conditions common to all the high altitude districts of the Colony, has already been reported on when dealing with the establishment of temporary grass and clover leys. There are, however, large areas of the country where improvement of permanent grasslands is of importance and to which the Officer in charge of Grassland Improvement devotes his attention as do the Agricultural Officers in European areas. The full report of the former is published amongst those of the specialist officers.

The comparatively high moisture areas at altitudes of 6,500 feet and above are mainly potential Kikuyu grass country and the aim here is the development of cultivated pastures of this grass and indigenous clover (*Trifolium Johnstonii*), a type of sward which can easily be produced and maintained in these areas in parts where it does not already exist. At somewhat lower altitudes, under climatic conditions which are similar except that the successful growth of this type of pasture appears to be limited probably by the higher temperatures experienced, the problem is to discover herbage types suited to more intensive grazing than has been practised hitherto. A considerable number of indigenous and introduced herbage and fodder plants are under experiment for this purpose.

Scott Agricultural Laboratories.

Here work was continued on the increase of material of new grasses collected from various parts of the country and an attempt was made, severely handicapped by locust attacks, to continue the system of cuts on an experimental block of seventy-two small plots designed to give information on seasonal yield of herbage and nutrients. At the Ngong, Kabete and Machakos Veterinary training centres observations were made on the effects of different intensities of grazing and of grass burning on the natural pastures.

The most promising grasses for sowing down pastures at the lower altitudes referred to above appear to be *Cynodon plectostachyum* (coarse variety), *Chloris gayana* (Australian strain), *Chloris gayana* (a selection from the indigenous strain), *Cynodon plectostachyum*, *Panicum coloratum*, *Amphilophis pertusa* and *Paspalum dilatatum*. Some of these grasses such as *Chloris gayana* (Rhodes grass) and *Cynodon plectostachyum* (Star Grass) are very suitable for making hay.

Pennisetum purpureum (Napier Grass), which is perhaps essentially a fodder crop in this country, is proving successful at many of the lower altitudes It is very drought-resistant, can be frequently cut and gives a good yield of green fodder and acts as a restorer of soil fertility after having been in the ground a year or so. It is also useful as a wash stop on eroded land. Other grasses which show promise are *Pennisetum giganteum*, a large *Echinochloa* species and *Panicum trichocladum*. Several leguminous plants are being tried for inclusion in pastures.

Njoro.

Some exotic grasess such as Perennial and Italian rye-grass, Timothy, Cocksfoot and Red Fescue were tried here. Their value is still problematical but the trials will continue. More attention was paid to trials of leguminous plants amongst which were the following :—

Trifolium pratense (Tennessee disease-resistant).
T. pratense (red or broad red).
T. pratense perenne (Montgomery late-flowering red).

T. pratense (Mammoth red).
T. hybridum (Alsike).
T. incarnatum (Crimson clover).
T. repens (White clover).
T. resupinatum (Persian clover).
T. cernum (Ginger clover).
T. dubium (Suckling clover).
T. subterraneum (Subterranean clover).
T. fragiferum (Strawberry clover).
T. glomeratum (Chester clover).
T. alexandrinum (Berseem clover), Gizo 1, 3, 5, 6 and 11.
Medicago denticulatum (Burr clover).
Lespedeza stipulacea (Korean).
Lespedeza striata (Japan clover).
Lespedeza sericea (Perennial lespedeza).
Sweet clovers (*Melilotus* spp.).
Common Biennial Yellow, Hubam clover (*M.alba annua*).
Lotus angustissimus (Narrow-leaved lotus).
Stylosanthes mucronata (Wild lucerne).

The existing plots will be continued and further plots of the annual species and the more promising biennials and perennials will be planted in 1934.

The following legumes were outstanding and showed a very marked resistance to drought :—

Lespedeza striata (var. Kobe) *Trifolium alexandrinum* (Berseem clover), *T. pratense* (red or broad red), *T. pratense perenne* (Montgomery late flowering red) and *Lespedeza sericea* (Perennial lespedeza).

Lespedeza striata (var. Kobe) and *L. sericea* may both be useful plants to use in conjunction with indigenous grasses for pastures.

Trans Nzoia.

In this district some 120 varieties of grasses and legumes were under trial.

Many of these trials have now reached the stage at which it will be necessary to endeavour to procure facilities for testing the plants as to their palatability, nutritive value, powers of recovery after grazing or cutting, and persistence.

The following plants at present are deemed worthy of investigation on a larger scale either in pure stands or in mixtures :—

Grasses—

Brachiaria platynota.
Digitaria scalarum (Blue couch).
Setaria aurea (Golden Timothy).
Setaria trinervia.
Themeda triandra (Red oat grass).
Panicum maximum (Red oat grass).
Panicum coloratum (Keria grass).
Melinus minutiflora (Molasses grass).
Chloris gayana (Rhodes grass).
Cynodon spp. (Star grasses).
Digitaria criantha (Woolly Finger grass).
Lolium perenne (English wild perennial rye grass).
Lolium perenne (New Zealand perennial rye grass).
Dactylis glomerata (Cocksfoot).
Agropyron cristatum (Crested wheat grass).
Paspalum scrobiculatum.
Paspalum dilatatum.
Phalaris tuberosa.
Amphilophis pertusa.
Pennisetum clandestinum (Kikuyu grass).
Panicum trichocladum.
Cynodon plectostachyum (Naivasha Star grass).
Brachearia brizantha.

Leguminous Plants—

Lespedeza sericea (Perennial lespedeza).
Lespedeza stipulacea (Korean lespedeza).
Lespedeza striata (Kobe lespedeza).
Lespedeza striata (Common).
Trifolium resupinatum (Shaftal clover).
Trifolium sp. (indigenous).
Trifolium sp. (local species of Kenya wild white clover).
Trifolium pratense (English broad red clover).
Trifolium pratense (Essex broad red clover).
Trifolium pratense (Brittany broad red clover).
Trifolium pratense (Chilean broad red clover).
Trifolium pratense (Norfolk broad red clover).
Medicago denticulata (Burr clover).
Lotus corniculatus (Bird's foot Trefoil).

Some experiments have been begun on paddocking to observe the effect of intensive grazing on indigenous veldt, on ploughing up indigenous veldt and planting with better grasses and to observe the effect of various fertilizers on the veldt. Other experiments have been started with silage and some plots have been planted up with the following crops to test their suitability for supplemental feeding of dairy cows :—

Elephant grass.
Sudan grass.
Sweet potatoes.
Edible canna.
Marrowstem kale.
Thousand-headed kale.

It is expected that these experiments will be greatly extended in future in co-operation with farmers possessing dairy herds, as the institution of mixed-farming in place of one-crop farming is regarded as of the greatest importance for the Trans Nzoia district.

Fodder Crops and Pasture work in connection with the low rainfall and purely stock-farming areas.

In the stock-farming areas which experience low and erratic rainfall the scope for development of high yielding pasture is very limited and the most important advance must be that of the production and storage of fodder in the form of hay and ensilage for use in the dry periods of the year coupled with control of the grazing over large areas to prevent the deterioration in the natural herbage consequent upon constant over-grazing. The application of these principles to European stock-farming should not present great difficulty, but progress in this direction amongst the stock-owning native tribes, which largely occupy the drier areas of the country, is bound up with custom and the adoption of a more settled way of living. Therefore advance will be gradual and intimately connected with general educational development. Cropping experiments in these directions are in progress.

Green Manure Crops.

A large number of green manure crops have been widely tried during past years and full reports have been published on them in previous annual reports but particularly in Bulletins Nos. 3 and 7 of 1932 and 2 and 3 of 1933, together with recommendations for their use. Some of them were indigenous legumes. Several new green manure crops were introduced into the Rift Valley Province this year and short notices on their behaviour are given below.

Molo.

Sword Bean (*Canavalia maritima*).—This crop was a complete failure.

Rongai.

Velvet Beans (*Stizolobium Deeringianum*).—Two varieties of these were planted but only a few plants survived the drought. These surviving plants set seed but the growth was very poor and they cannot be considered as possible green manure crops for this area.

Njahi Beans (*Dolichos lablab*).—Twenty varieties of these beans were tried, the seed having been obtained from India. Two failed to germinate, the remainder making only very indifferent growth. Five varieties were of a bush type, showing no tendency to climb, and these will be compared with local *Njahi* beans to determine whether they are more suitable for a green manure crop.

Horse Gram (*Dolichos biflorus*).—Twenty varieties of hore gram from India were tried as being possibly suitable for green-manuring crops. One variety failed to germinate and the remainder suffered so severely from the drought that it is considered advisable to try some of the relatively better strains in 1934 before making definite recommendations.

Cover Crops.

Since these are invariably used in connection with coffee a few notes on the most outstanding ones will be found under the section devoted to investigational work on coffee.

Crop Trials.

Past annual reports and Bulletins Nos. 3 and 7 of 1932 and No. 2 of 1933 give some idea of the extent to which trials of new crops have been undertaken in recent years by this Department. The crop trials of 1933, whether for cash, fodder, or green-manuring purposes, are merely a continuation of work which has been in progress for some years. It should be appreciated that crops are first of all imported in small quantities for observational trials and possible acclimatization and that it is not until the obviously best have been multiplied up that they can, after a year or so, be subjected to comparative yield trials conducted in such a way as to be capable of statistical interpretation. In this report, therefore, some of the crops reported on are under observation only whilst others are undergoing a real comparative yield test, having been imported in previous years.

As far as possible the crop trials have been put under headings, such as cash crops, green-manure crops, fodder and pasture crops, but it will be understood that since a crop sometimes serves several purposes, each has been put under the heading giving the purpose for which it is most likely to be used in the European areas of this country.

Cash Crops.

Potatoes—(a) Variety Trials.

Njoro.—The following varieties were tried in a manner capable of statistical interpretation :—

Variety	*Yield in tons per acre*
Incomer	5.48
Doon Star	2.57
Native variety	2.48
Allanah	1.73
Golden Wonder	1.69
Great Scot	1.62
Kerr's Pink	1.40

The differences between Golden Wonder, Great Scot, Doon Star and Native are not significant. Kerr's Pink, usually a good yielder, suffered very badly from Early Blight and from the appearance of the leaves during early growth the presence of virus disease is suspected. Allanah, Golden Wonder and Great Scot all suffered badly from Early Blight whilst Incomer, Doon Star and the Native selection showed considerable resistance. The poor yields can be attributed to the severe drought experienced during the early growth of the crop. There are several so-called "Native varieties" grown in the native reserves which are the progeny of a number of European varieties imported some years ago.

Scott Agricultural Laboratories.

Three new varieties, Arran Crest, Arran Pilot and Commander, were imported during the year. Owing to the severe drought which prevailed throughout the early part of the year practically the whole of the seed was lost. A further consignment is being imported.

Variety trials during the October rains which yielded very much below average, again showed that Baron is a good yielder under low rainfall conditions. A recent importation, Arran Scout, is also worthy of special mention. Both of these varieties yielded considerably higher than Kerr's Pink, which was used as the control for comparison.

Potato Virus.—Experiments with this disease were continued at the Plant Breeding Station, Njoro, and at the Scott Agricultural Laboratories. Higher yields were obtained from seed which had been grown at higher altitudes but the experiments did not disclose whether these higher yields were due to the seed having come from a higher altitude or to freedom from virus. An experiment to be carried out in 1934 with seed drawn from more strictly comparative localities is likely to give more conclusive results.

(*b*) *Fertilizer Trials.*

Njoro.—This took the form of a five-sided latin square. The object was to test the effect of different quantities of a complete fertilizer on yields. The fertilizer, applied at the rate of 200 lb. to the acre, was a mixture of superphosphate, sulphate of ammonia and sulphate of potash. The quantities of each fertilizer used were arranged so that the amounts of P^2O^5N and K^2C were applied in the following proportions, respectively :—(*a*) 1 : 1 : 2, (*b*) 2 : 1 : 2, (*c*) 2 : 2 : 1, (*d*) 1 : 2 : 1, with a control (no fertilizers). The plot was planted on the 10th May.

Plots (*c*) and (*d*) were given nitrogen in two dressings; the first was given when the fertilizer as a whole was applied and the second on the 15th July.

Twenty of the plots were sprayed with Burgundy mixture on the 31st July, when Early Blight first appeared, the remaining five plots, consisting of a control and one plot each of the above treatments, were left unsprayed. A second spraying was intended but the very heavy rainfall experienced in August made the task impossible.

The plot was harvested on the 13th October. Statistical interpretation showed that treatments B, C and D were significantly greater than A, and that B and C were significantly greater than the control but the yields, owing to the bad season, were too low to justify any definite conclusions being drawn.

No difference was noted between sprayed and unsprayed plots; this can be attributed to the fact that when the rains did fall the crop had already spent itself and in spite of the rains at the end of July and August no further growth was made.

The experiment was rather vitiated owing to the poor season, the yields only ranging from 16 to 23 cwt. to the acre.

Molo.—This experiment took the form of a four-sided latin square, and was designed to compare the following manurial treatments, the plots being 1/48th acre each in size :—

A.—No manure.

B.—Cattle manure at 8 tons per acre.

C.—Cattle manure at 8 tons plus artificials at 200 lb. per acre.

D.—Artificials at 200 lb. per acre.

The artificial manure was composed of superphosphate 40 lb., sulphate of ammonia 35 lb., and sulphate of potash 25 lb. per 100 lb. of compound fertilizer, or a $P^2 0^5$; N : $K^2 0$ ratio of approximately 1 : 1 : 2. The following results were obtained :—

Treatment	Yield per Acre	Ware	Seed	Chats
	Tons	*Per Cent*	*Per cent*	*Per cent*
A. Control	5·33	64·8	26·8	8·4
B. Cattle Manure	5·55	59·9	32·4	7·7
C. Cattle Manure Artificials	5·36	60·5	29·8	9·7
D. Artificials	4·56	58·9	32·3	8·8

Standard Error = 5.409 lb. per plot or .117 tons per acre. Any difference in yield between treatment exceeding three times this figure, that is, .351 tons per acre can be therefore regarded as significant.

It can thus be stated that treatments A, B and C all gave a significantly greater yield per acre than treatment D, but any difference in yield between these three treatments was not sufficiently large to be significant.

These results would suggest that the application of artificial fertilizers to potato crops under Molo conditions has a depressing effect on the yield.

Linseed.

Flax was grown extensively and successfully during the boom years of 1919–1920 but the disastrous fall in prices in 1921 put a sudden end to the industry. Experience gained during the flax boom showed, however, that wilt could be a very dangerous disease if the plant were grown on the same land for more than one year and that the wilt remained in the soil for several years in succession. Many of the linseeds suitable for the oil-trade which are under trial now are therefore varieties which have been found to be resistant to wilt in other countries.

Rongai.—Owing to the drought, yields were very low but can be regarded as comparative. The plots were arranged for observation purposes only and these results are not capable of statistical interpretation.

Variety	Yield per Acre Bag 200 lb.	Remarks
	Bags	
La Plata ..	3·33	Germination poor, height 17″, droughted
Persian Gulf ..	4·75	Poor stand, height 14″, droughted.
Morocco ..	5·23	Poor stand, height 14″, droughted.
Bull Moose ..	6·0	Good stand, drought resistant, long maturing, height 18″.
Calcutta ..	3·21	These varieties only reached a height of 9 inches.
Bombay ..	1·96	
T. 12	2·88	
T. 121.. ..	2·47	
T. 124.. ..	2·06	
H. 10	1·03	
H. 13	1·17	

The yields given by 1, 2, 3 and 4 can be regarded as highly satisfactory in such an unfavourable season as that of 1933, and larger scale experiments with these varieties will be carried out.

There was no occurrence of wilt, but until the resistance of these varieties to this disease is proved in this country, past experience indicates that farmers would be wise to rotate their crops so that linseed is not grown on the same land in successive years.

Njoro.—Owing to the indication of the high yielding ability of Morocco, La Plata and Persian Gulf varieties imported and tried in 1932, it was decided to compare their yields by the half-drill strip method against a variety, name unknown, grown locally by farmers.

As the seeds of the imported varieties were rather larger than the local variety a small quantity of seed of all varieties was weighed and counts made, to find out as nearly as possible the number of seeds per pound in each variety. The object of doing this was to find out the seed rate necessary for each variety so as to get a more or less even stand of plants to the acre throughout.

The germination of the imported varieties was not good, but that of the local variety was very poor, and owing to this, fresh strips were again planted later in the year, but again the locally-grown seed failed to germinate.

As the local variety was such a failure, comparisons were impossible and it was considered inadvisable to work the results out statistically.

In spite of the weak germination and bad season the imported varieties gave yields of five to seven bags to the acre. The drilling of the imported varieties at a seed rate of 68 lb. to the acre gave a poor stand and it is considered advisable in future to try heavier rates of seeding; 75 to 80 lb. to the acre would in all probability give an adequate stand. The following is the result of the strip yields :—

Morocco	7.3	bags of	200 lb.	per acre.
La Plata	5.1	,,	,,	,,
Persian Gulf	5.1	,,	,,	,,

The linseed varieties named below were also tried. In America the first five are reported on as showing satisfactory resistance to wilt combined with immunity to rust. There was not a sufficient quantity of seed for a yield trial so observations only on their growth were taken.

Variety	Growth	Habit of Growth
Bison C.I. 389	Good	Tall
Redwing	Very Good	,,
Ottawa	,,	,,
Rio	,,	,,
Bull Moose	Good	,,
Unknown Variety from Col. Stack, Mau Summit	Poor	Short
Bombay; Pusa L. 12; Eritrean; Calcutta	Failed to germinate.	

Molo.—Small observation plots of eight varieties were planted. Seed rates employed varied from 45 lb. to the acre in the case of the smallest seeded variety, i.e. Redwing, to 65 lb. per acre in the case of Persian Gulf, which has the largest seeds. This was done in order to get the number of plants per acre approximately equal in each variety.

Although the results given below cannot be regarded as accurate on account of the smallness of the plots, an idea of the relative yielding capacity of the individual varieties can be gathered.

Variety	Yield per Acre	Remarks
	Bags of 200 *lb.*	
1. La Plata ..	7·94	Tallish flax type, long maturing, height 17″
2. Persian Gulf	5·68	Linseed type, early maturing, height 14″
3. Morocco ..	4·26	Similar to Persian Gulf, height 14″
4. Bull Moose	11·15	Inclined to flax type, medium maturity, height 16″
5. Bison ..	9·85	Flax type, medium maturity, height 17″
6. Rio ..	11·0	Slender, linseed type, small seed, height 15″
7. Ottawa ..	11·57	Linseed type, white flowers and seed, height 16″
8. Redwing ..	12·7	Early maturing, linseed type, small seed height 14″

There was no occurrence of wilt, but no risks should be taken by planting linseed after linseed on the same land. Varieties 5 to 8 inclusive are said to be resistant to wilt disease and flax rust in the United States.

Trans Nzoia.—A number of varieties were grown for seed on the plots of Mr. Cardale Luck's farm. This crop looks to be of great promise but, as the quantities of seed available were very small, yields which would be comparable to those obtainable on the field scale cannot be given. Each plot of linseed was about 80 square yards in size and thus, at a seed-rate of about 100 lb. per acre, should have received a little over 1½ lb. of seed per plot.

Variety	Maximum Height	Approximate Weight Seed Used	Yield per Acre
	Ft. ins.	*Ounces*	*Bags of* 200 *lb.*
La Plata	3 6	1¼	3·57
Persian Gulf	3 1	2¾	2·80
Morocco	3 0	2¼	2·53
H. 10	2 0	1¼	2·02
H. 13	2 0	1½	2·40
La Plata T. 12	1 6	1¾	2·15
T. 121	1 9	2¼	2·47
T. 124	1 9	1¼	1·51
Bombay	2 0	2½	1·11
Calcutta	1 9	2	3·21

Beans.

Beans of the haricot type have been tried at various stations in the Nakuru and other districts for some years but it is doubtful whether they yield well enough to give an economic return to European farmers and they often suffer badly from bacterial blight in the wetter and colder districts.

Trans Nzoia :—

Variety	Yield per Acre
	Bags of 200 *lb.*
Danubian Pearl Bean ..	4·5
Otenashi	2·74
Kotenashi	3·63
Roumanian Haricot	1·12
Light Fawn Haricot (Victory)	0·76
White and Purple Haricot ..	5·65

These suffered badly from bacterial blight and rust and if beans of this sort are to be at all successful in a rather wet district such as the Trans Nzoia, they should be planted after the main rains are over.

Rongai.—The following varieties were grown in observation plots but owing to the drought only very poor yields were obtained.

Variety	Yield per Acre
	Bags of 200 *lb.*
Japanese Otenashi	1·19
Roumanian Haricot	1·19
Robust Pink	2·08
White Sugar Bean	3·48
Basutoland Yellow	1·47
Victory Bean	2·57

The first three beans are suitable for export as dried beans and on actual farming practice larger yields, up to five bags per acre, can be expected in a season with a good rainfall. The last three varieties have no market at present unless grown for native consumption.

Single rows were grown of the following beans, which were introduced from Canada by Mr. Whitmore, but no yields were taken :—

(1) Brown Kidney Bean—very dwarf; yellowish-brown bean.

(2) Canadian Red Bean—heavy cropper; tall bush type.

(3) Bocchini Bean—heavy cropper; tall bush type.

(4) Canadian Yellow Eye—semi-climber, robust, fair cropper.

(5) White H.P. Bean—dwarf type, very small white bean.

These varieties will be grown for further trial in 1934 with acclimatized seed, as there is a possible market for them in Canada.

Madagascar Butter Beans and White Runner Beans.

This type of bean is being used with increasing success at the lower altitudes as a green manure crop on account of its long period of growth. Madagascar butter bean is also proving successful as a drought resistant cash crop with normally a good market value.

Groundnuts.

Rongai.—Two varieties of groundnuts, namely, Virginia Bunch and Spanish Bunch, were tried. These in common with all previous groundnut trials were a failure. It is hoped that it may be found possible to grow groundnuts with success at as high an altitude as at Rongai if trials of certain early maturing varieties, now in progress in the Central Province, prove successful.

Granadillas.

Trans Nzoia.—Considerable correspondence was exchanged between the Department and Trade Commissioner for the East African Dependencies and Mr. H. A. Neale, of England, on the subject of the possibilities of an export trade from Kenya of granadilla juice for use as a flavouring for ices, non-alcoholic drinks, etc. The Agricultural Officer, Kitale, eventually prepared and dispatched two samples of juice, one being frozen and the other preserved with sodium benzoate. Reports received on these samples were most favourable and an export industry is now in prospect.

Rice.

Trans Nzoia.—Twenty-five varieties of rice were tried in one of the swamps near Kitale in the Trans Nzoia. They were all a failure owing to shortage of rain. These swamps are extensive and the Agricultural Officer is attempting to prove rice with the object of interesting European farmers in this crop, which is quite profitable at moderate yields.

Onions:

Trans Nzoia.—Through the kindness of Messrs. O'Toole and Company, Ltd., Kitale, the trials of onions were continued during 1933. Seed of nine varieties was planted in nursery-beds on January 17th, the bulbs were planted out on April 13th and 18th and the crop was harvested at the beginning of September. Complete success was obtained with the varieties Yellow Bermuda and Early Hunter River, both on sandy soil derived from gneisses and on a loam, with murram about three feet below, derived from volcanic material. The Yellow Bermuda onions averaged .9 lb. per bulb and the Early Hunter River .75 lb. per bulb. The latter onions are harder and the more attractive for export purposes. Some selected bulbs of this variety kept well till January and were planted in the hope of producing seed.

Trials of Crops suitable for Canning.

Some of these crops, such as the marrowfat peas, had been tried before for other purposes, but since there is under consideration the possibility of establishing a canning trade for vegetable crops in this country a number of crops were tried with this object in view, chiefly by the Agricultural Officer, Trans Nzoia, who investigated this subject during his recent absence on home leave.

The following varieties of peas were tried :—

Variety	Yield per Acre
	Bags of 200 lb.
MOLO	
Eclipse	Failure
Lincoln	3·05
Lincolnshire Blue	2·88
English Blue	4·78
Witham Wonder	Failure
Kelvedon	"
Admiral Beatty	"
NJORO	
Witham Wonder	2
Lincoln	4

The season was a poor one.

Trans Nzoia.—Alaska, Surprise, Lincoln, English Blue and Lincolnshire Blue were tried.

All these peas made good growth and only the test of preparation in the can will determine which is the most suitable variety to grow should a canning factory be erected. Alaska and Surprise yielded poorly, largely owing to defective germination, but they will doubtless yield better on acclimatization, Lincoln gave 4.64 bags per acre. Samples of the two Blue Peas, which are processed before canning, were despatched to England in order to obtain a report on their value by Dr. Hirst of the Fruit and Vegetable Preservation Research Station, Chipping Campden, Gloucestershire.

The following crops were also tried :—

Beans—

Keeney's Green Refugee.
Burpee's Stringless Greenpod.
Refugee.

These are stringless beans for canning. Bacterial blight and rust were present as with all bean species. Burpee's Stringless Green pod was the healthiest of the three but it is probable that these diseases would not be largely in evidence at the time at which the pods would be plucked for canning.

Carrots—

Early Nantes.
Champion Horn.
Early Horn.
Amsterdam Forcing.
Nantes Coreless.
Sutton's Giant Round Forcing.
Stump Rooted.

An excellent crop of carrots which was, on the whole of high quality, was obtained. The yields varied between 103,000 and 15,300 lb. of marketable carrots per acre.

The best varieties from a canning point of view appeared to be the Nantes Coreless and the Champion Horn.

Beetroot—

Sutton's Globe.
Detroit Dark Red.

These roots germinated badly and subsequently suffered heavily from insect attack.

Turnip—

Sutton's Snowball.

The turnip produced roots of a high quality and would appear to be very well suited to the district as a canning vegetable.

Spinach—

Longstanding Round.

Germination was strong but subsequently the whole plot withered off.

Asparagus—

Mary Washington.
Sutton's Giant French.
Argenteuil.

These plants are at present in the nursery.

Tomatoes—

Ailsa Craig.
Best of All.
Buckley.
Carter's Seedless Fruit.
Comet.
Globe.
Italian Plum.
Marglobe.
Peachblow.
Princess of Wales.
Sunrise.

These tomatoes were planted in the nursery on August 7th and planted out on October 2nd. They began to fruit at the beginning of January, being watered by hand throughout the dry weather. By growing the tomatoes at this time of the year an excessive amount of Septoria leaf spot, Blossom end rot, etc., was avoided. Splitting, a common trouble of tomatoes in the Trans Nzoia, was not greatly in evidence and some varieties escaped almost entirely. All varieties bore very heavily but yields were not recorded. A trellis of fencing wire and sticks was employed to support the plants which were kept pruned to single stems. A dressing of 100 lb. per acre of superphosphate, 100 lb. of bonemeal and 200 lb. of sulphate of ammonia was applied.

From these trials it seems that any of these varieties might grown without difficulty for purposes of canning or the manufacture of tomato *puree* in the Trans Nzoia. The variety Sunrise perhaps deserves special mention as being a very prolific tomato of rather small size but of excellent quality. This variety showed little or no splitting of the fruits and little disease. The Italian plum tomato, a variety much used for canning in Europe, was also successful, while Peachblow and Ailsa Craig were very free from splitting.

Marrowfat Pea Trials for the Packet Trade.

(A) Variety Trials.

A large number of peas suitable for this trade had been given an extended trial at the Njoro Plant Breeding Station and a few other centres in 1932. In 1933 the three varieties which had been found best were given a further trial. These were the Dutch, Japanese and Harrison's Glory (English) Marrowfats. Japanese Marrowfats fetch rather lower prices than the other two as they are smaller in size. The results of the yield trials of these peas at the different centres are given below.

Rongai—

Variety	*Yield: bags of 200 lb. per acre*
Dutch Marrowfats	6.41
Japanese	7.51
Harrison's Glory	6.78

All these are worth growing at Rongai although a smaller percentage of exportable green peas must be expected than at the higher altitudes, owing to the increased heat of the sun. With shade-drying it should be possible, however, to obtain as much as 50 to 60 per cent of peas of exportable standard from the gross weight harvested. This would give a return of approximately £5 to £6 per acre for the Dutch and Harrison's Glory types. It is important to remember, however, that the value of the remaining 40 to 50 per cent of bleached peas would be in the neighbourhood of Sh. 10 per acre.

Njoro.—At this centre the same varieties gave poor yields of from one to four bags per acre. This was due to three reasons, bad germination, too light a rate of seeding and a poor season. Another important experiment was, however, done on marrowfat peas at this station, which will be discussed later in this report.

Molo—

Variety	*Yield: bags of 200 lb. per acre*
Dutch Marrowfats	6.25
Japanese	4.49
Harrison's Glory	4.97

On the whole the season was a poor one for this crop and better yields than those can be anticipated normally. Although the marrowfat pea crop does not lend itself to large-scale farming, it would fit, very particularly at the higher altitudes, into a diversified farming system, and a farmer with a capacity for taking pains with the harvest would be able to cope with five to ten acres.

Trans Nzoia.—The following varieties were tried for the first time :—

Variety	*Yield: bags of 200 lb. per acre*
Dutch Marrowfat	4.04
Japanese Marrowfat	5.12
Harrison's Glory	5.08
Koopman's Glory	2.85
Sharp's Standard	2.74
Challenge	5.10
Dwarf Defiance	4.44
Admiral Beatty	4.18

Growth was generally excellent and there was little disease with the exception of a slight amount of mildew late in the season and the development of leaf spots in a moderate degree on some varieties. The resultant crop was of high quality, though one or two varieties were largely spoilt by late October rains, thereby emphasizing the necessity for storage room, under cover, for the ripe pea haulms.

Scott Laboratories, Nairobi.—A number of varieties suitable either for the packet or canning trade were tried out during both the long and short rains. Observations made indicated that several varieties were worthy of an extended trial by market gardeners near Nairobi for local consumption as a substitute for the ordinary field peas usually grown and sold for the green pea trade. These were :—

Pilot; Dwarf Defiance—early varieties.
British Lion—medium early variety.
Sharp's Standard—late variety.
Harrison's Glory—very late variety.

(*B*) *Experiments on the Preparation of Marrowfat peas for the Export Packet Trade.*

This important piece of work was carried out at the Plant Breeding Station, Njoro, with the object of being able to advise farmers how to harvest and handle marrowfat peas so as to obtain the highest yield per acre of exportable green peas and the top price on the market. It will be appreciated that, for the packet trade, it is essential for the dried peas to be a nice green colour and for them to contain no bleached peas, as these detract materially from the value of the consignment. The crop does not ripen evenly and in 1932 the pods, when they had reached the right stage, were harvested singly by hand. This method was, however, found to be too expensive and resulted in considerable unevenness in the sample owing to the unreliability of the natives employed on the work.

In 1933, therefore, attention was given to pulling the peas on the haulms when the plants showed varying degrees of maturity as indicated by the proportion of bleached and green pods. The plants were then subjected to further treatments embodying sun-drying as opposed to shade-drying.

The three varieties, Dutch, Japanese and Harrison's Glory were employed for the test and the following methods of harvesting were tried :—

(*a*) Pulling the haulms, leaving them in the field and turning them daily until dry;

(*b*) pulling the haulms, making them into small wads, leaving them in the field, turning frequently until dry;

(*c*) pulling the haulms, and drying round tripods in the field, no turning necessary;

(*d*) pulling the haulms, leaving them to wither for a day in the field, then finishing the drying in an open shed.

Under the above headings the stages of maturity varied, from the earliest time considered advisable when only 30 to 35 per cent of the pods were bleached, through stages up to when 75 per cent of the pods were bleached.

The above experiment showed that :—

(*a*) shade-drying in every case was most satisfactory;

(*b*) pulling the haulms when 30 to 35 per cent of the pods were bleached was the most satisfactory time to harvest.

As an example of (*a*) when Dutch and Japanese Marrowfats were harvested with 50 per cent of the pods bleached the percentage of exportable green peas was 31 and 39 per cent respectively when sun-dried, whereas the percentage rose to 60 per cent and 65 per cent when these samples were shade-dried.

The greatest success attained was with the shade-dried sample harvested when only 30 to 35 per cent of the pods were bleached. On threshing it was found that no less than 78 per cent of the peas were green and fit for export, so that only 22 per cent had to be removed by hand-picking.

Twelve samples of marrowfats harvested under different methods were sent to the Kenya Farmers' Association who forwarded them to an interested firm in England for report. Some of the samples had been hand-picked to remove all bleached peas whilst others were sent exactly as harvested. The reports were most interesting. The shade-dried sample of Dutch marrowfats harvsted when only 30 to 35 per cent of the pods were bleached and which produced 78 per cent of exportable green peas was valued, after the 22 per cent of blanched peas had been hand-picked out, at £23 per ton. Samples not hand-picked were only valued at £18 to £19 per ton. Not only was the value reduced by omitting to hand-pick them but the firm in question said it was difficult to find a market for such peas at all in competition with those imported into England from other countries.

It transpires, therefore, that marrowfat peas must be hand-picked and that they must be dried in the shade so that the amount and cost of hand-picking necessary may be reduced to a minimum. As regards the amount of hand-picking to be done, choosing the proper time for harvesting is as important as shade-drying, since harvesting too late results in the production of a very large proportion of blanched peas. The less hand-picking that has to be done the less the cost of producing the finished article and the higher the yield per acre of exportable green peas; in fact every effort must be made to produce the highest possible percentage of green peas at harvest time. On the other hand the peas must not be harvested too long before complete maturity or the final sample will be lacking in boldness and contain too many undersized and very wrinkled peas.

The cost of hand-picking a bag of peas which does not contain a very large proportion of blanched peas is estimated to be about Sh. 2, so long as the hand-picking is done by labour sitting around a table on which the peas are deposited and not around a tarpaulin on the ground. The tarpaulin method is expensive and inefficient.

The firm reporting on the sample did not know the names of the varieties submitted for report or the treatments which were given, but they valued the good sample of Dutch Marrowfats at £23 per ton and the Japanese at only £20. The good sample of Harrison's Glory was valued nearly as high as the Dutch. It should be mentioned that the blanched peas are suitable for seed.

A full report on how to grow, harvest and treat marrowfat peas so as to obtain a high yield per acre of first class exportable green peas has been published in the local press.

Investigational Work on Special Crops.

Coffee.

Pruning.

Observations on the influence of pruning at different periods in relation to flowering constituted an important feature of this work in the Kiambu–Ruiru area as well as at the Scott Agricultural Laboratories. Comparisons of yields produced under the multiple and single-stem systems of pruning were continued at the Scott Agricultural Laboratories. Owing to certain climatic conditions the single-stem system was inferior to the multiple system last year but an average taken over five years is in favour of the latter. With regard to neglected coffee, pruning the trees heavily was again found to be distinctly advantageous over parrot-perching them. The advisability of protecting freshly stumped trees with preservative was again proved.

Spraying.

Tests were carried out with two sprays, namely, 1 per cent Carbide Bordeaux mixture and ½ per cent Burgundy mixture. It was noted with both sprays that spraying during the acute period of the drought had a detrimental effect on trees carrying a crop, both on the trees and the crop. Generally speaking, however, sprayed trees which had been stripped or were carrying no crop showed a more marked recovery than those unsprayed. That spraying with these mixtures was not so successful during the 1933 drought as it had been in past years should not deter farmers from making extensive use of this treatment which normally greatly increases the vitality of the plant.

Observations on root-systems and the effect on them and the trees of various treatments.

This work was done at the Scott Agricultural Laboratories. Thatching with grass was found to be very beneficial, much more so than were applications of cattle manure, and an experiment completed during the year showed the importance of careful hand-weeding and cultivation and that the constant removal of natural leaf mulches from under a tree did nothing but harm. Other observations on root systems are in progress which should provide valuable information in time on how best to manage the growing crop.

Vegetative Propagation.

By cuttings.—At the Scott Agricultural Laboratories propagation by etiolating sucker growth, whilst still attached to the parent stem, was again shown to be the only successful method of striking cuttings and it was interesting to note that the root systems of such rooted cuttings were quite as good as those of seedling trees.

By grafting.—Grafting having been proved successful the previous year a start was made during 1933 on investigating the value of a number of different root stocks by grafting on to them scion wood from one variety only—Kent's Selected.

Vegetative Propagation Experiments at Sotik and Turbo in connection with Coffee Berry Disease Investigations.

Rooting of suckers by etiolation was found most successful at Sotik also and as was found at the Scott Agricultural Laboratories, all attempts to root coffee cuttings were a complete failure.

Grafting of selected material on to seedling stock of certain special strains of coffee in Mr. Newton's nurseries at Turbo was found successful, the number of grafts which "took" varying from 65 per cent to 85 per cent. Grafting on to selected strains of old coffee at Sotik also proved a successful operation. Strong unions were made by cleft grafting and this type of grafting is recommended as being the best. *Coffea robusta* types sent up from the Scott Agricultural Laboratories for trial as root stocks were not found successful, as they died out under Sotik conditions. Success having been achieved with the technique of grafting, the scope of the work is being widened to include scion stock of types and individual plants apparently resistant to Coffee Berry Disease.

Variety trials and single trees selections.

A large number of species and varieties of coffee are still under observation at the Scott Laboratories, the variety Harar being outstanding amongst recent importations. An attempt to find outstanding hybrids on the Scott Laboratory plantations is still being pursued.

Green manure crops, cover crops and shade trees.

A number of new cover crops and shade trees were under observation but it is too early as yet to make any recommendations concerning them. The most promising cover crops for the drier areas appear to be *Coronilla varia*, *Indigofera pratenus* and Cossack lucerne (*Medicago sativa*) and for the wetter areas *Calopogoniam orthocarpum*, *Calopogonium mucunoides* and *Glycine javanica*.

Trans Nzoia.

Some investigational work on coffee was started on the new Government plot near Kitale. The conditions there are quite different from the Kiambu–Ruiru area and a number of different varieties of coffee are being tried as well as shade trees. Also various cultural methods, soil treatments, etc., are under investigation.

Pests and Diseases.

Coffee Mealy Bug (*Pseudococcus lilacinus*).—Work was continued on this pest until the departure on leave of the Entomologist concerned. No method of control other than the previous one of banding against the attendant ants was evolved but it is now hoped, with the help of Farnham Laboratories, to introduce effective parasites of the bug. Fortunately this pest only exists in the Kiambu–Ruiru coffee area and was not at all virulent during the year under review.

Asterolecanium coffeae Newst.—Some investigations into this pest, which favours the hotter and drier districts at an altitude between 4,000 ft. and 5,000 ft., were also made. It is recommended that trees in badly infested plantations should be stumped just before making new growth and the new growth inspected at regular intervals to ensure the early detection of re-infestation.

Antestia.—Two officers devoted most of their attention to a detailed study of this serious pest and its parasites and with the conditions influencing the severity of its attacks. For this work they were equipped with a field laboratory and meteorological statoin at Kasarini estate, a portion of which was loaned by Mr. P. J. H. Coldham for the purpose. Though experiments on control measures were unfinished at the end of the year, the superiority of properly supervised pyrethrum-kerosene extract spraying over all other methods was demonstrated.

Elgon Die Back.—Investigations were made into the problems of the causes and control of this new local disease which is assuming serious proportions in the Trans Nzoia. The disease appears to be associated with certain conditions of exposure and aspect.

Coffee Berry Disease.—Most of the work on this disease was concentrated at the experimental station in Sotik. Field experiments on spraying, soil treatments and cultural methods, as well as observations on special trees and on a number of varieties of coffee for resistance to the disease continued to be the main features of the work. Investigations were made in the laboratory to discover the reason for the unsatisfactory results of spraying in the field, but with no results. Considerable attention was devoted to finding out the most successful methods of propagating coffee vegetatively in the district in case any resistant trees or varieties are found.

Distribution of Soil Moisture under various Covers.

The Senior Agricultural Chemist continued work on this subject during the year. Under the low rainfall conditions of 1933 there was no doubt that the most efficient conserves of soil moisture were grass and soil mulches. The former conserves both top and subsoil moisture, the latter subsoil moisture. Both short and long period cover crops tended to deplete the soil of water. It was also observed that the typical red coffee subsoil is capable of retaining a very large proportion of the rainfall, much of which it would yield to coffee during times of stress.

Physiological studies.—The Senior Agricultural Chemist has undertaken a few physiological studies. Three forms of die back, including that known as Elgon Die Back, have been recognized, each differing in its ultimate cause and in the final result. Measurements made on coffee trees have shown normal rapid growth during the period of bud formation and flowering, a progressive diminution of rate of growth during the formation of the crop, with complete cessation during die back due to the nitrogen supply being inadequate to the needs of the crop. Trees carrying a smaller crop showed continuous vertical growth indicating that when the nutrient supply is adequate both growth and crop production can proceed simultaneously.

Much of this work leads to the conclusion that closer study of the coffee plant would throw much light on other problems, and that it is dangerous to attempt to generalize on its behaviour from a few observations.

Maize.

Experiments devised to improve maize yields by discovery of the best cultural methods and by finding the best types of maize to select for seed, and also the spacing experiments and trials of different methods of planting to obtain a good stand, have by now been more or less completed and the results published for the information of farmers. These methods of improving yields per acre have now been largely adopted by farmers and will result in producing the crop more economically. The Division is now concentrating on longer range work, that is, the breeding, by selfing, of strains of maize resistant to the more serious diseases found in the Colony, namely Fusarium diseases and White Blight (*Helminthosporium turcicum*). Results will not be obtained for some years to come and it is already apparent that difficulty will be experienced in breeding types resistant to the Fusarium diseases and that any success that may be attained will have to be helped out by the adoption by farmers of the better cultural and field sanitation methods already advocated.

The breeding of better strains of maize by selfing was continued both at the Njoro Plant Breeding Station and in the Trans Nzoia (6,000 ft. altitude and with a prolonged rainfall), the latter work being undertaken by the Agricultural Officer there. At Njoro the problem is to produce a flinty dent type of maize resistant to diseases and able to give good yields at altitudes previously considered too cold for maize. That such work at Njoro may have results applicable over a wide area is evidenced by the fact that maize seed from Njoro district often yields better at the lower altitudes than seed which has been grown locally. In the Trans Nzoia there are two specific problems to be dealt with, namely Fusarium diseases and White Blight. Considerable progress has been made with regard to breeding strains resistant to the latter but the Fusarium diseases, manifested largely by Pink Ear Rot, are a much more difficult problem.

Mr. Thorold gave considerable assistance by identifying a number of the diseases of maize prevalent in the Trans Nzoia.

Under the care of the Agricultural Officer at the Scott Laboratories and with the advice of the Senior Plant Breeder work was continued on a type of white dent maize called Muratha which is being bred and improved by selection (not by selfing) for resistance to White Blight and for early maturity. Early maturing is of paramount importance for the natives in the adjoining Kikuyu Province, where the rainy seasons are short—a condition aggravated by the shortness of the daylight hours (and growing period) on the Equator. Considerable progress has been made in this work and Muratha maize now yields about 50 per cent better than the ordinary native maize. Progress was considerably delayed during 1935 owing to the drought.

The detailed report of maize breeding undertaken by the Department appears in the annual report of the Acting Senior Plant Breeder.

Maize Seed Competitions.—The Maize Seed Competitions were continued this year both at Njoro and Kitale. The purpose of them is to improve the quality of seed used by farmers both as to yielding capacity and disease-resistance, and they provide a real test of the value of each entrant's seed. These competitions have been fully discussed in past bulletins. It will suffice to say with regard to this year's competitions that they were very poorly supported, there being no entries for the Kitale section and only nine for the Njoro section. This poor support can be ascribed to the depression in the maize industry caused by poor prices and to the ravages of locusts. It is hoped that by means of more propaganda and certain alterations in the conditions of entry they will be better supported next year, since the use of proved good seed throughout the Colony is one of the chief factors which will contribute towards arresting the present trend towards deterioration both in the quality of maize exported and in yields per acre. There was a 30 per cent difference in yield between the seed of the top and bottom competitors in the ranking list at Njoro, which is sufficient to show the value of the competition. The same farmers did well as in previous years, which demonstrated the intrinsic value of their seed. The seed entered by the Plant Breeding Station was top, but was not significantly better than that of several other competitors.

Wheat.

As in past years, the staff of the Plant Breeding Services continued to devote its attention mainly to the production of rust-resistant wheats of good milling quality, high productive capacity and suitable to the diverse conditions obtaining at the higher altitudes of 9,000 ft., the medium altitudes of 7,000 ft. and the lower altitudes of 6,000 ft. where wheats which mature in five to seven months can be grown on account of the long season which obtains. Work was also continued on similar wheats suitable for other districts with altitudes of 7,000 ft. and 5,000 ft. where the time of maturity should not exceed four months on account of the shortness of the rainy seasons. The rusts involved at 7,000 ft. and over are Stem Rust, Yellow Rust, Leaf Rust, but below that altitude Yellow Rust is usually absent. There are four distinct physiologic strains of Stem Rust and an unknown number of strains of Yellow and Leaf Rust.

The wheat breeding centres were situated at the Plant Breeding Station, Njoro (7,000 ft.), at Marindas Farm, Molo 9,200 ft.), and at the Scott Agricultural Laboratories (5,600 ft.). The wheat breeding cage on Major Drought's farm at Mau Summit (8,400 ft.) was moved to Marindas Farm, Molo (9,200 ft.) with, as anticipated, more beneficial results since the colder temperatures and greater humidity obtaining at Marindas Farm have resulted in much more favourable conditions for severe epidemics of Yellow Rust.

The full report of the year's work appears in the Acting Senior Plant Breeder's report. It should be said here, however, that it transpired during the year that most gratifying progress has been made in the production of rust-resistant, good milling quality wheats. The wheats under review are the result of crosses made between wheats previously bred by the Senior Plant Breeder and Experimentalist, which were resistant to all the physiologic strains of Stem and Yellow Rust (but unfortunately of poor milling quality) and other wheats which were of good milling quality and resistant to Yellow Rust but susceptible to Stem Rust. The new varieties are now in some bulk and ready for issue to farmers. They appear to possess all the desirable agronomic qualities as well as rust resistance and good baking quality. These wheats are suitable for altitudes of 7,000 ft. and over with a long growing season and it is in these areas that most of the wheat in this country is now grown. Several stem rust resistant wheats such as B.256.G. and Sabanero are already available for altitudes of 6,000 ft. with a long growing season.

With regard to the districts of 7,000 ft. and below where very short maturing wheats are required, extremely good varieties with rust resistance and good milling quality have been produced, now in some bulk, whose only fault is that they are susceptible to one of the four physiologic forms of stem rust. These are good enough to go on with but, utilizing the two short rainy seasons at the Scott Laboratories last year, further suitable crosses were made and the F.1 generations grown during the short rains at the end of the year.

It is confidently anticipated that varieties resistant to all four physiologic forms of stem rust and to leaf rust will result from these new crosses.

An outstanding feature of this breeding work has been that many of the new strains of wheat appear from preliminary chemical and physical tests on small quantities to be of good baking quality. These tests were made by Dr. D. W. Kent-Jones of the Laboratories, Charlton Green, Dover, through the good offices of the Kenya Grain Mills (Kenya, Ltd.) Nairobi. Good baking quality is at all times difficult to obtain and recognize when breeding wheat as it has to be recognized during the early stages, and it is made doubly difficult in Kenya by the absence of such machinery for testing small quantities of wheat as is provided in other countries where finances have not been so curtailed. Further baking tests are being made on seventeen of these wheats and in view of this, it is not proposed to say more about them until next year's report.

Artificial epidemics of Stem Rust (Puccinia graminis).—The Mycological Section gave considerable help by the production of artificial rust epidemics amongst the hybrid wheats and the junior staff at the Plant Breeding Services did a large number of seedling inoculations of the new varieties to confirm their rust resistance.

A fairly satisfactory artificial infection of stem rust was produced amongst the hybrid wheats at the Scott Agricultural Laboratories by the Mycologist at Njoro, which was of great assistance to the Plant Breeder in making selections. From researches made, climatic conditions did not appear to be the dominant factor in determining the presence of one form rather than another.

Investigations into Physiologic forms of Yellow Rust (Puccinia glumarum).—The Mycologist at Njoro grew eleven varieties (differential hosts) of wheat imported from Germany at several high altitude farms in this country as a preliminary to finding out how many physiologic forms of yellow rust exist here. These varieties certainly exhibited different reactions to natural infection with the rust but, so far as field tests are concerned, difficulties are likely to arise since some of the varieties of wheat are winter types and some spring.

Take All of Wheat (Ophiobolus graminis).—A piece of land badly infected with this disease was found in the Molo area in which rotation experiments with grasses and other crops will be undertaken with a view to providing information on the ecology of this very serious disease. It is hoped to find out what rotations are advisable and necessary to eradicate it.

Vernalization.—Experiments were begun with the vernalization of wheat and maize to shorten the period of growth of these crops but have not so far been successful.

Essential Oils.

Of the varieties of geranium under trial at the Scott Agricultural Laboratories, four give oils of good quality and resembling each other very closely. Although the odour characteristics of these oils are not those of Bourbon or Algerian oils, they have a very pleasant note and are definitely saleable in competition with these oils. Peppermint oil has been exported in an experimental quantity during the year and has been most favourably received on the London market. The quality of the oil is most sensitive to soil and climatic conditions, some oils being utterly valueless while others are of very high quality indeed.

Cedar wood oil has remained a large item in the exports of essential oils. It has been shown that from oils from young trees more cedrol crystallizes than from oils from mature and old trees. The colour of the oil appears to be closely connected with locality.

Sisal.

The plants of *Agave amaniensis* received from the Amani Research Institute are under trial at the Scott Agricultural Laboratories. These are making markedly quicker growth than the common *Agave sisalana* planted in an adjoining plot. The former is under trial also on several sisal estates following an arrangement between the Department and the Amani Institute.

Pyrethrum.

The higher the altitude the more even and continuous is the flowering of pyrethrum, with increasing yields. From a one-year old field at about 9,000 ft. a yield of 10 cwt. of dried flowers per acre has been recorded.

It has been found by the Senior Agricultural Chemist that the percentage of pyrethrin in the flowers is higher in the Kenya Highlands than is normally found to be the case in other countries which export the product. Attempts are being made to breed higher yielding plants which will retain the high pyrethrin content. High pyrethrin content is the important factor on the world-market and if the growers can also obtain a high yield of flowers per acre the position of Kenya as a producer of pyrethrin should be a favourable one as against competing countries.

The Entomological Section spent a considerable amount of time in devising means to evaluate biologically the toxicity of pyrethrin extracts from various samples of flowers.

Agricultural Services.

Native Areas.

The re-organization of native services which took place in 1931, chiefly by replacement of unqualified officers by suitable men recruited under the Colonial Agricultural Scholarship Scheme, and more recently by the decentralization effected through placing officers in charge of the agricultural work in Provinces, has borne fruit and progress is now rapidly under way. In next year's report it will be possible to give facts and figures in proof of this in substantially greater degree than is given this year, for 1933 has been an exceptionally bad year for production and 1934 has opened with every promise of a normal season. Nevertheless, as will be seen, the export of the non-edible products, cotton and wattle-bark, has shown a marked increase; the bad season caused edible products to be retained in the Reserves. The monetary value of improvement in the quality of the staple edible products of which the surplus is sold out of the reserves, such as maize, sesame, groundnuts and beans, cannot therefore be shown in respect of the work in the last few years up to the end of 1933, but an example, maize, may be given based on a normal season, as well as an example in respect of an export product, wattle-bark. In both cases the improvement has been brought about by inspection services under legislation prohibiting the purchase or sale of inferior qualities for transport out of the Reserves.

Maize.—The increase in value is estimated by the General Manager, Kenya Farmers' Association (Co-operative), Ltd., in respect of maize leaving the reserves, to be an average throughout of 50 cents per bag. In a normal season the surplus leaving the reserves is estimated by the Association, which is in close touch with the whole of the maize trade, at 500,000 bags; this makes the sum of £12,500 as the total annual value of improvement in the quality of maize. The mixed-colour maize has practically disappeared and a large part of the production is fully equal in value to export European maize.

Wattle Bark.—The Kenya Manager of the Natal Tanning Extract Co., which is a subsidiary company of the Forestal Lands, Timber and Railways Company, Limited, has given the Department his view of the improvement in the quality of wattle-bark, in the following words : "In 1931 native wattle-bark from Kenya was classed as more or less equal to No. 3 Natal bark and was worth over 30/- per ton less than No. 1 Natal bark. To-day, this Kenya bark is fully equal in market appearance to No. 1 Natal bark but is classed as equal to No. 2, purely because of the lower tannin content, which makes it worth about 7/6 to 10/- per ton below Natal No. 1. This lower tannin content is due entirely to immature stripping and we feel that this factor is being improved under the present system of inspection."

Unfortunately Kenya suffers by comparison with neighbouring countries, due to the fact that it has no large areas suited to the usual East African Native export products, such as cotton, groundnuts, and sesame. The large native agricultural tribes are situated in highlands which are not suited to these products. Cotton and groundnuts are confined to the fringes of the Coast and the Lake, although experiments in cotton are in progress at a number of points immediately below the Highlands, which are believed to be suited to this crop, and a groundnut planting campaign is being undertaken in the Machakos district, which is traversed by the railway to the Coast. Groundnuts are also to be tried in the new cotton areas. On the other hand there is a large area of native reserve, in both the Central and Nyanza Provinces, which is suited to coffee. The first native coffee nurseries are being opened in 1934. The value of what is known to the Division as the "provincial organization" of native services I have left for the Agricultural Officers in charge of the Provinces themselves to describe in their own words in the Provincial reports which follow. The actual work in the reserves will be found described in these reports. Certain salient features will be treated administratively in the following paragraphs.

Land Reclamation.—This is of two kinds : (*a*) reconditioning of land rendered barren through over-stocking, and (*b*) swamp reclamation. The former consists only of small acreages for demonstration purposes and has been particularly successful in the Machakos district, where individual natives are carrying out on their land the object lesson provided. Swamp reclamation during 1933 has been on a fairly large scale in the Fort Hall and South Nyeri districts, where 4,500 acres of rich low-lying lands have been drained under the supervision of the Agricultural Officers, and are now under cultivation, supporting a large number of native families. These swamp lands are exceptionally fertile, there is a great area of them and reclamation will proceed every year.

Irrigation Schemes.—The irrigation possibilities of the dry inland coastal areas and the Kano Plains area in Nyanza Province have been examined by Agricultural Officers prior to the visit of an irrigation engineer with the Economic Botanist, Kew, and much agricultural and soil information has been gathered to show their potential productivity.

Experimental and Investigational Work.—This work is now being undertaken on Local Native Council seed farms, with funds provided by Government, and comprises simple trials of new crops or new varieties of crops, with trials of methods of cultivation and selection work on certain native crops. The last is particularly important and covers, sorghums, pigeon pea, maize, eleusine, and groundnuts. No selection work is done for cotton as, through the courtesy of the Uganda Department of Agriculture, the new Uganda strains are sent to this Department as soon as bulking begins in that country. The Scott Agricultural Laboratories and the Bukura Native Training Farm help considerably with this work. Experiment stations, however, are badly needed in the reserves, particularly in connection with native mixed farming which the Department is attempting to introduce (see next two paragraphs). In the higher parts of the Central Province an important feature of the experimental work is the introduction of suitable crops for the short rains—the low mean temperature, the short day and the briefness of the rains make this no easy matter.

Animal Husbandry.—Officers of the Plant Industry Division give a certain amount of their time to animal husbandry services in reserves, in the absence of the officers of the other Division. This work covers particularly improvement in hides and skins, improvement of poultry by the breeding and distribution of pure breeds, and the introduction of mixed farming as a means of maintaining the fertility of the soil.

Soil Fertility.—The importance of this matter in the more closely populated native reserves in which shifting cultivation has come to an end has been stressed in previous reports. The only permanent corrective in the depletion of soil fertility which is taking place, under annual cropping without restoration of plant foods, is a small-holding, mixed-farming system of native cultivation which by experiment the Division has proved to be practicable and profitable wherever the native enjoys the occupation of a single piece of land of sufficient size for the purpose. The present system of land tenure, involving excessive fragmentation, needs to be radically altered before this reform can be begun on any scale. A temporary means of mitigating effects of depletion of soil fertility exists in the higher parts of the Kikuyu Reserve, by planting the wattle tree, which has heavy root nodulation, occurring naturally, and a considerable leaf-fall—these provide for renovation of the soil and at the same time give the native an economic return through sale of wattle-bark and timber. The tree, however, occupies the land for seven years before the annual crop can again be planted, and land is becoming too valuable to be kept for this length of time under a product which is neither high-priced nor edible.

Inspection of Produce.—The wattle-bark inspection services have been extended now throughout the Central Province and no bark leaves the Province without inspection by native instructors, trained for the purpose. Inspection is to be extended to maize in 1934. In the Nyanza Province, maize, groundnuts and simsim are inspected in the principal buying centres. The results in improving the value of the product have been rapid.

Local Native Council Farms.—These have now almost entirely displaced departmental issues of seeds in the Central and Nyanza Provinces. Owing to the wide distances and differing climatic conditions, it has been necessary to have, in addition to the main seed farm, one or two small plots of a few acres, with competent native instructors in charge. A few of them have proved unsuccessful and these have been closed. The system is now thoroughly established, and is being found to be of great value in improving the quality of local produce.

Organized Marketing.—Low commodity prices are still a handicap to the extension of controlled marketing, but the greatest handicap is the lack of suitable legislation to enforce it. This is to receive the attention of the Government in 1934. The Central Province report shows the value of even the half-way efforts that have been made for the controlled marketing of wattle-bark; a more comprehensive scheme is in preparation, for introduction when the necessary legislation is passed. The only other products of which the marketing is controlled are cotton and cashew nuts, the former in the Central and Nyanza Provinces, the latter in the Coast Province alone. The specific legislation for these two crops allows of controlled marketing and the results have been successful.

Native Agricultural Committees.—These are committees of the Local Native Councils and have been established in the Central Province, with the district Agricultural Officer as chairman. In the words of the Agricultural Officer for the Province: "We have found these committees extremely useful as they provide Agricultural Officers with the opportunity of thoroughly discussing any project, and obtaining the support of the members, before the matter is brought up to the Local Native Council. Too often one finds there are so many matters to discuss at a full Council meeting that unless a project is cut and dried beforehand it is difficult to get it adopted.

Native Agricultural Schools.—Training at the Department's native schools at the Scott Agricultural Laboratories and at Bukura in North Kavirondo, proceeded satisfactorily; the number of apprentices, sixty at the former and fifty-six at the latter, was the same as in 1932.

Apprentices at the school at the Scott Agricultural Laboratories were drawn from districts as follows:—

> Kiambu 11, South Nyeri and Keruguya 12, Fort Hall 2, Embu 8, Meru 9, Akamba 10, Teita 3 and Masai 3.

Seventeen apprentices completed the course of instruction and twenty-four new entrants were admitted.

Apprentices spend thirty-four hours weekly on field work and ten hours on instruction in school. In addition to crop work and general agricultural practice, facilities are provided for the pupils to obtain a knowledge of poultry keeping, the care of implements and the management of a small holding.

The practical value of the small holding increases each year; it enables instruction in mixed farming to be given and demonstrates the interdependence of animals and crops in farm economy. A system of rotational grazing of paddocks of the holding was commenced during the year with beneficial results. Locusts and drought lowered the carrying capacity of the paddocks in previous years, but under the rotational system considerable improvement of sward was observed and the carrying capacity increased.

At the Bukura School apprentices came from areas as follows:—

Central Kavirondo (Luo) 21. North Kavirondo (Bantu) 14, Kisii 6, Nandi 5, Marakwet 4, Lumbwa 4 and Elgeyo 2.

For the first time trained Lumbwa, Marakwet and Nandi apprentices became available at the end of their course of instruction, for employment as native agricultural instructors in their respective districts. There is evidence that the demand for trained instructors in the pastoral areas is increasing.

As part of instruction received during the third year of the course, some apprentices were sent out into the native reserve during busy seasons such as that of cotton planting to gain experience in the duties of an agricultural instructor.

Training in small-holding mixed farming is also given at Bukura.

The nature of employment obtained by apprentices after completion of the course of instruction is summarized in the following table:—

Nature of Employment	1925–9	1930	1931	1932	1933
SCOTT AGRICULTURAL LABORATORIES					
Native Agricultural Instructors	45	10	6	10	9
Forestry	2	2	—	—	—
Educational Work	4	4	1	1	1
Alliance High School	1	—	3	—	—
European Farms	—	1	1	—	—
Other Work	11	—	—	1	1
Returned to Native Reserve	6	3	3	6	6
BUKURA SCHOOL					
Native Agricultural Instructors	24	4	9	11	11
Educational Work	2	1	1	1	1
European Farms	—	1	—	—	—
Other Work	2	1	—	—	—
Returned to Native Reserve	5	1	4	9	3

Table Showing (*a*) Total Revenue; (*b*) Expenditure on Agricultural and Forestry Services—for all Native Councils during the Past Three Years.

Council and Province	1931		1932		1933	
	Revenue	Expenditure on Agriculture and Forestry	Revenue	Expenditure on Agriculture and Forestry	Revenue	Expenditure on Agriculture and Forestry
	Sh.	Sh.	Sh.	Sh.	Sh.	Sh.
Digo	30,654	6,209	16,695	5,835	16,881	3,837
Giriama.. ..	45,052	4,824	39,514	5,351	31,609	11,299
Teita	52,472	1,987	14,774	2,464	14,220	2,094
Coast ..	128,178	13,020	70,983	13,650	62,710	17,230
N. Kavirondo ..	229,279	22,988	220,431	19,571	176,589	14,242
C.Kavirondo ..	107,971	9,742	187,247	16,896	141,318	25,337
S. Kav. (K-N)	66,882	9,491	57,424	11,674	57,871	12,099
S. Kav. (L-A) ..	65,266	4,179	69,574	3,895	62,532	10,378
S. Lumbwa ..	10,414	1,115	29,061	1,305	30,644	3,331
Nyanza ..	479,812	47,515	563,737	53,341	468,954	65,387
Nandi	32,196	14,175	23,738	7,987	36,082	5,832
Elgeyo	23,671	5,088	..	..	14,739	2,117
Marakwet ..	7,050	1,565	19,232	4,732	..	..
Nzoia ..	62,917	20,828	42,970	12,719	50,821	7,949
Baringo I ..	16,285	1,727				
Baringo II ..	3,882	..	11,809	4,749	8,701	4,356
Rift Valley	20,167	1,727	11,809	4,749	8,701	4,356
Kiambu ..	64,562	8,442	70,797	14,013	99,496	3,713
Fort Hall ..	72,903	10,963	84,987	18,247	78,971	9,044
S. Nyeri ..	75,219	29,138	71,958	12,916	63,501	4,982
Embu	33,547	1,999	19,211	2,944	37,662	6,153
Meru	54,605	7,966	32,956	18,334	17,346	2,571
Kikuyu ..	300,836	58,508	279,909	66,454	296,976	26,263
Machakos ..	123,066	25,433	124,259	33,259	119,314	36,201
Kitui	64,055	2,871	54,440	4,179	58,225	3,918
Ukamba ..	187,121	28,304	178,699	37,438	177,539	40,119
Narok	23,044	48	31,192	..	20,972	..
Kajiado ..	41,988	..	39,407	293	29,265	597
Masai ..	65,032	48	70,599	293	50,237	597
W. Suk ..	7,213	..	4,089	442	3,560	308
Turkana ..	2,561	..	2,664	..	2,770	..
Turkana ..	9,774	..	6,753	442	6,330	308
Total	1,253,837	169,950	1,225,459	189,086	1,122,268	162,209

SEED ISSUES.

A feature of considerable importance during the year was the increase in supplies of seed and tree seedlings made available for distribution by Local Native Council Seed Farms. Seed grown on these farms is acclimatized and thus more suitable for areas concerned. Also it is available for distribution at any time required for sowing, and transport costs involved in obtaining supplies from a distance are saved. Quantities obtained from this source were supplemented by supplies from Local Native Council and Department funds. In normal circumstances seed farms provided bulk supplies for distribution in limited areas to replace inferior varieties, and the Department supplied seed for bulking or trial.

Particulars of quantities and distribution by Provinces and the Turkana and Northern Frontier Districts are given in the following tables.

These three tables indicate the more important seed issues made during the year :—

SEED ISSUES—NATIVE RESERVES. FROM DEPARTMENTAL FUNDS.

Seed	Unit	Coast Province	Central Province	Nyanza Province	Rift Valley Province	Turkana Province	Northern Frontier Province	Total
Maize, White	bag	30	18½	2	3	5	2	60½
Maize, Yellow	,,	83	..	..	..	..	..	83
Sorghum ..	,,	10	..	..	3	..	3	16
Marrowfat peas ..	lb.	..	..	100	..	..	..	100
Beans, Canadian Wonder	bag	..	..	..	15	..	1	16
Beans, Madagascar Butter ..	,,	..	10	..	1	2	..	13
Potatoes ..	cwt.	18	127	55	14¾	..	..	214¾
Vegetable seeds ..	ozs.	..	163	96	32	..	..	291
Groundnuts ..	frasila	..	71	365	..	6	6	448
Simsim ..	,,	..	191	..	..	1½	..	192½
Fruit trees ..	No.	..	10	..	..	6	..	16
Ginger roots ..	lb.	..	30	250	..	..	..	280
Lucerne ..	,,	..	..	6	..	..	..	6
Linseed ..	,,	..	90	30	60	..	..	180
Edible Canna	,,	..	900	..	..	..	..	900
Wattle seed ..	,,	..	200	..	..	..	..	200
Cowpeas ..	bag	6	..	..	..	..	..	6
Tepary Beans	,,	5	..	..	..	..	..	5
Bulrush Millet	,,	3	..	..	..	..	..	3

SEED ISSUES—NATIVE RESERVES.

From Local Native Council Seed Farms.

Seed	Unit	Province			Total
		Rift Valley	Central	*Nyanza	
Maize, White	bag	140	428	461	1,029
Potatoes	,,	110	1,029	368	1,507
Beans	,,	23	183	34	240
Peas	,,	6	31	23	60
Millet	,,	..	14	27	41
Cowpeas	,,	..	15	..	15
Simsim	,,	..	21	..	21
Groundnuts ..	,,	..	10	..	10
Pigeon Peas ..	,,	..	4½	..	4½
Sorghum	,,	..	14	5	19
Green gram ..	,,	..	5	..	5
Tree transplants ..	,,	..	..	234,920	234,920
Fruit Trees ..	,,	..	..	11,000	11,000
Tobacco W. D. Nyasa	lb.	..	..	22	22
Linseed	bag	5	..	..	5

*Includes issues from Bukura Farm.

SEED ISSUES—NATIVE RESERVES. From Local Native Council Funds.

Seed	Unit	Central Province	Nyanza Province	Total
Maize, White	bag	200	40	240
Field peas	,,	10	..	10
Wattle seed	lb.	14	500	514
Potatoes	bag	22	40	62
Vegetable seeds	lb.	20	122½	142½
Fruit trees	No.	12	..	12
Groundnuts	frasila	55	2,270	2,325
Wheat	bag	10	..	10
Tung Oil	lb.	..	95	95
Tree Seed, var.	,,	..	84	84
Linseed	bag	..	150	150

PROVINCIAL REPORTS

CENTRAL PROVINCE.

(*formerly Kikuyu and Ukamba Provinces*)

Report of the Agricultural Officer in Charge of the Province.

The Province carries a population of 1,214,876 natives, and is divided into seven Administrative Districts.

ADMINISTRATIVE

District Staff		Native Agricultural Instructors	
District	Agricultural Officers	Departmental	L.N.C.
S. Nyeri ..	*Mr. W. G. Leckie	6	—
Fort Hall ..	Mr. P. C. Chambers	9	4
Kiambu ..	†Mr. W. O. Sunman	4	3
Embu ..	Mr. A. S. Hartley and Mr. D. H. Cairns	7	1
Meru ..	Nil	3	—
Machakos ..	Mr. R. T. Hobbs	6	2
Kitui	‡Mr. R. Humphrey	2	—

*Provincial Agricultural Officer. †Part-time services only.
‡Posted to Kitui on return from leave in December.

Provincial Organization.—The organization commenced late in 1932 was consolidated during the year and proved of great value in co-ordinating the policies of the various districts under the Provincial Agricultural Officer in collaboration with Head Office and the Provincial Commissioner. This Officer preserves the close touch which is so essential, with all the agricultural activities of the Province and is in a position to see these activities in their proper perspective and advise on measures for the increase of prosperity. He keeps in close contact with the Administration and particularly the Provincial Commissioner. This is made a much simpler task where, as in Nyeri, the Provincial Agricultural Officer is working side by side with Administrative Headquarters. During the past year it has been possible to discuss and settle numerous matters affecting the policy of the whole Province with minimum expense and waste of time.

One of the chief difficulties encountered in the past by District Agricultural Officers has been to establish trading relations with other districts and to enlarge the marketing scope of natives in areas with which they are concerned. It is obviously simpler for an officer who is in close touch with the districts of the whole Province, and with officers administering them, to assist natives in their marketing and to regulate supply and demand. He is in a position to initiate crops over a wide area with the knowledge that a market can be found. He acts as a liaison officer between the various Local Native Councils and the larger buying firms and from the information at his disposal is able to eliminate the carrying out of separate correspondence by the several District Agricultural Officers on similar matters.

One of the points which has arisen during the year is the inadequacy of the vote for transport at the disposal of the Provincial Agricultural Officer. This officer must be in a position to carry out periodical inspections of the progress of the work in each District. An allowance of six hundred miles per month is required in order that the greatest use can be made of his services.

Seasonal Conditions.

Most abnormal weather conditions were experienced over the whole Province during the year. The 1932 short rains continued well on into February and very heavy crops of millets and maize were harvested in March. These prolonged rains were, however, the forerunners of a drought, unprecedented in the known history of the Province. The severity of the drought varied from district to district, the most hard-hit being Nyeri, Machakos, Kitui and Meru. The rains which fell in these district occurred in spasmodic showers which were soon dissipated by a blazing sun. The fact that no famine relief was necessary shows how greatly the native has advanced in general agricultural practice and in his method of storing food crops. Such a drought occurring ten years ago would undoubtedly have led to a severe famine.

Diseases and Pests.

Some slight damage to crops was done by locusts in isolated areas. Army caterpillar, cut-worm and *Gonocephalum* beetle were particularly troublesome during the year, doing considerable damage to all young crops.

LOCAL NATIVE COUNCILS SEED FARMS

District	Seed Farms	Total Acreages	Acreages in Cultivation	Altitudes
				Feet
1. S. Nyeri ..	Nyeri	38	30·55	5,900
	Gichiche	8	8	6,800
2. Fort Hall..	Fort Hall	40	40	4,500
	Wakoma's	19	16	7,500
	Githu's	6	4	6,500
3.*Kiambu ..	C.S.M., Dagoretti..	—	8	7,000
4. Embu ..	Embu	29	29	4,400
	Keruguya	9·9	9·9	5,000
5. Meru ..	Meru	24	13·5	5,400
	Chuka	6·5	2·5	5,000
	Iringa	6	6	4,600
6. Machakos	Machakos	40	35	5,300
	Masai	10	10	4,400
	Matiliku	6	6	3,600
	Kibwezi	7	7	2,700
7. Kitui ..	Kitui	40	25	3,860

*Plot opened March, no crops harvested owing to drought.

These seed farms serve as a nucleus for the agricultural work of the district or area differing in natural conditions, in which they are placed. When any particular crop has been proved by trial, acclimatized seed is bulked on these farms and issued to natives. The main function of any one farm depends naturally on its geographic and climatic position. Those seed farms situated between 4,000 ft. and 6,000 ft. are mainly concerned with the bulking of Muratha maize in the "long rains" and various varieties of beans, millets and peas in the "short rains". At the higher elevations the crops being bulked are proved varieties of potatoes and peas. At the lower elevations the work is still mainly in the experimental stage although sufficient progress has been made with trials of imported sorghums and millets to justify their being bulked for immediate issue.

Improved Implements.

In addition to the bulking of seed these farms offer the necessary scope for the trials of new implements and demonstrations of their working. In this connection the recent importation of a light Indian type plough weighing only 43 lb. is likely to be of value to the Kikuyu with his small scattered shambas.

Organized Demonstrations.

Periodic demonstrations are given at these farms on the work in progress. The demonstrations include such points as spacing trials, terracing, green manuring, results of applications of boma manure, use of labour-saving implements, selection of seed in the field and trials of new crops.

Experimental Results.

Plant Trials.

This is a most important branch of the work and has already proved its value in the introduction of quick-maturing and drought-resistant crops for famine areas. One hundred and fifteen plant trials were carried out during the year. The results of the more important and promising crops are shown below. As already stated seasonal conditions were very poor and it has therefore been an unfortunate year for experimental work.

*CROP YIELDS

CROP	FORT HALL		S. NYERI		EMBU	
	Yield per Acre	Growing Period	Yield per Acre	Growing Period	Yield per Acre	Growing Period
	Lb.	*Days*	*Lb.*	*Days*	*Lb.*	*Days*
Sorghum—						
Early Red Kaffir . .	124	136	—	—	247	120
Dwarf Milo . .	284	145	—	—	370	131
Sunrise Kaffir . .	548	145	—	—	740	136
Beans—						
Rose Coco	800	80	695	120	—	—
Noyeau Blanc . .	800	80	644	110	—	—
Canadian Wonder . .	800	80	—	—	—	—
Pinto	600	60	—	—	620	65
Awned Bulrush Millet	285	140	—	—	—	—
Rice—Kisuki . .	3,500	180 (from seed)	—	—	—	—
Linseed, Bombay . .	285	140	—	—	—	—

*Short rains 1932–3 only; all crops failed in long rains due to drought.

Seed Selection.

The variety of climatic conditions obtaining in the Province necessitates a great deal of seed selection work. The table below shows the crops on which work has been done and the aims in view.

Maize is the most important crop in normal years and a great deal of work has been done in selecting a type suited to conditions obtaining in the Kikuyu country. This work, on native Muratha, was started at the Scott Agricultural Laboratories some years ago and seed has since been bulked on all Local Native Council seed farms throughout the Province. Selection towards a flint, early-maturing type of maize takes place on the seed farms. Steady improvement has taken place in the quality of native maize, although the drought this year has been a severe handicap to progress.

CROP	Zone	Aims
1. Muratha Maize . .	Intermediate 4,000 to 5,800 feet . .	Early maturing, heavy yielding, flint type.
2. Muratha Maize . .	High 5,800 to 7,500 ft.	Early maturing, resistance to white blight.
3. Millets awned . .	Low and intermediate	To fix the awned and heavy yielding characters.
4. Sorghums	Low	Early maturing, resistance to mildew, yield.
5. Pigeon Peas . .	Low	Early maturing, high yields.

Manurial Experiments.

Two randomized block manurial experiments were laid down on seed farms situated one on the foothills of the Aberdares and one on the foothills of Mt. Kenya. The experiments are designed to discover the reason for the rapid loss of fertility which takes place when these light soils are put under cultivation. As these soils cover an area of 400 square miles in the Province, the problem is one of major importance. It is too early for any results to be obtainable.

Cotton Trials.

Cotton trials were laid down in Kitui district in November and arrangements have been made for extensive trials over the lower parts of the Machakos, Fort Hall, Embu and Meru Districts.

The Agricultural Officer, Scott Agricultural Laboratories, reports as follows on the mixed planting experiment conducted in the laboratory grounds :—

Mixed native planting versus separate planting.

This experiment was laid down early in 1933 in the form of a four-sided latin square. Each plot is 1/15th of an acre.

The object of the experiment is to prove whether the separate method of planting produces heavier yields than the mixed method and whether the rate of seeding with the mixed method of planting is a defective factor in native practice. Mixed planting is generally a sound practice under existing conditions of native economy, but it is believed that the spacing of the crops is usually wholly erroneous.

The experiment can be of little value until it has been in progress for several years as soil fertility is one of the main factors and this cannot be expected to give results at an early date. Both the seasons in which the records have so far been obtained have been ones of severe drought and yields consequently very small.

New Crops.

The crops shown below have been introduced into the Province during the year and give promise of becoming economically important. In this connection particular mention must be made of the imported varieties of sorghums, millets and Tepary beans. These crops are drought resistant and early maturing as compared with the indigenous native varieties, and when bulked and issued will make all the difference between famine and plenty to those natives situated in the lower areas. Taking the sorghums as an example, the native type grows through and is dependent on both long and short rains, maturing in nine to eleven months. Should one or other of the rains fail there is no crop. The imported sorghum matures in under five months and two crops per annum can be obtained in a good season.

NEW CROPS

	Kitui	Embu	Meru	Nyeri	Fort Hall	Machakos
(1)	Cotton	Coffee	Sorghums	Marrow-fat Peas	Beans	Simsim
(2)	Simsim	Mad. Butter Beans	Millets		M.B. Beans	Groundnuts
(3)	Groundnuts	Beans	Mad. B. Beans	Millets	Sorghums	Muratha Maize
(4)	..	P. Lady Beans	..	Mad. B. Beans	Rice	Pigeon Peas
(5)	..	Sorghums	..	..	..	..
(6)	..	Millets	..	..	..	Tepary Beans
(7)	..	Tepary Beans	..	..	..	..
(8)	..	Wattle				

New Crops.

Seed Distribution.

The distribution of improved types of seed such as maize, liable to cross-fertilization, is undertaken location by location in rotation. When possible bulk issues are made in these locations which are at the same time receiving the attention of the Medical Department for improved sanitary conditions. For seed issues to be successful a large staff of responsible natives is required for a short period to follow up individual issues to ensure that the seed is properly planted. This staff can only be obtained by working in collaboration with other Departments.

Crops likely to be of exportable value are issued to selected natives in the initial stages.

Particulars of seeds issued obtained from all sources of supply will be found in the report of the Deputy Director.

Improvement in Quality of Produce.

In these days of keen world-competition, quality of produce is the main deciding factor in obtaining and holding export markets. With unsettled and often falling prices, it has been difficult to show natives that there is any benefit to be gained by improving their produce. Local buyers in Reserves are not helpful, their main idea being to obtain quantity, usually at the expense of quality.

Wattle bark has been the main exportable commodity produced in the Province during the year and in order to maintain our markets it was found necessary to considerably improve the quality of bark. To this end rules were brought into force making it unlawful to strip trees for the production of dry bark during the rainy seasons. To facilitate inspection further rules were made making it unlawful for producers to sell bark except in stick form. A trial inspection system was then instituted at Karatina in South Nyeri District. This system involved the inspection of every bundle of bark before sale and the destruction of any bark below F.A.Q. quality. The immediate improvement in quality was so pronounced that it was decided the system should be extended to cover the Province.

The Wattle Marketing Rules were drawn up under the Crop Production and Live Stock Ordinance making it unlawful to remove bark from specified areas without having first passed inspection at gazetted centres. Wattle-inspection pass tickets are provided by the inspector for each consignment of bark passed by him. As a result of this system the quality of the bark throughout the Province has improved very substantially and rapidly and all that remains is to improve the tannin content by preventing immature cutting; legislation exists for this, but it is difficult to enforce.

The system of inspection described above can be applied to any crop for which the market requires a definite standard of quality. The inspection centres, situated as they are in the native reserves, will prevent the heavy losses incurred in the past in the transport of commodities which are later condemned. They are also invaluable for the rapid spread of propaganda among natives.

The quality of other crops such as maize and beans is gradually being improved.

Increased Production.

Drought conditions, running hand in hand with low soil fertility in certain large areas, have been the limiting factors to increased production of food crops over the greater part of the Province. Embu and Keruguya have, however, greatly increased production in maize, and at the end of the year were in the happy position of holding good stocks which fetched high prices.

In Kikuyu country at elevations over 5,000 feet the production of wattle bark increased. This tree was introduced into Embu during the year and hundreds of acres were planted under the direct supervision of the Department. Propaganda for the planting of steep eroded hillsides to this tree has met with success in Kiambu, Fort Hall and Nyeri.

Marketing.

The Kikuyu Co-operative Marketing Association, Kiambu, was dissolved during the year. The marketing scheme is now the same for the three districts of Kiambu, Fort Hall and Nyeri; the Local Native Councils erect stores and appoint a buying agent. The agent is expected to buy any produce brought to the stores on a commission basis and the Council receives a lien from the commission agent per ton of produce handled. This lien pays interest to the Council on the capital sunk in the stores and equipment, and provides the wages of the native store clerks.

Throughout the year the scheme has worked well although practically the only produce handled has been wattle bark.

The following tonnages for wattle bark purchased through the Local Native Council stores show the great advance which has been made during the year in gaining the confidence of the natives; through the agency of the scheme prices have been steadied and held at a reasonable level :—

	1932	1933
	Tons	*Tons*
South Nyeri	80	1,584
Fort Hall	159	2,315
Kiambu	564	2,557
Total ..	803	6,456

Having built up a solid foundation for the marketing scheme on wattle bark, it is intended that other produce should be marketed through the scheme in 1934. The experience obtained in marketing in this Province points to the fact that there must be, at least, one readily exportable crop which can be depended upon to form a nucleus and stand-by; and it is important that the Local Native Council stores should be situated on rail. With the present low prices ruling for native commodities it has been found inadvisable to extend the scheme to those districts situated far from rail.

Soil Fertility and Erosion.

Soil fertility and erosion are serious problems throughout the Province, calling for strong action before it is too late for economic remedial measures to have effect. Much of the Kikuyu country must eventually be terraced if it is to remain under cultivation in seasonal crops.

In order to maintain soil fertility native practice depends on a rotation in bush. The population of the reserves is steadily increasing so that already we have areas in Kikuyu carrying a population of six hundred inhabitants per square mile. It is obvious that the practice of recovering fertility under bush, in these areas, can no longer be carried out and the position is therefore most serious. The solution is the small mixed holding, which has been demonstrated at the Scott Agricultural Laboratories during the past three years. This method, although practicable in Kiambu District where land can be purchased outright is precluded under the system of land tenure obtaining in other districts, excepting for the actual Githaka owners.

The position is so urgent that remedial measures are being carried out and urged on the following lines :—

(*a*) Village compost pits. Already widespread in Embu district.

(*b*) Stall feeding of cattle for manure. Napier grass is being planted for this purpose.

(*c*) The planting up of wattle on worn-out lands. This remedial measure has met with the greatest success and a large proportion of the poorest land has been planted up to wattle during the year. The greater popularity of this measure is due to the fact that not only does wattle restore fertility but it also provides a small income from the sale of bark, building poles and firewood.

A reconditioning demonstration was laid down in late 1932 at Mbooni in the Machakos district. A typical eroded hillside was taken, destocked, contour trenched and planted up with various indigenous and imported grasses and fodder plants. The result obtained, in spite of the drought, is most encouraging, the behaviour of an indigenous *Cynodon* grass species being noteworthy for its fast spreading and drought resistant habits.

Work on reconditioning a further area at Kiteta was commenced this year. This area is to be destocked and divided into three sections; one section to be trenched by hand and planted up; the second section to be trenched by plough and planted up; and the third section to be left untouched. The information obtained from this experiment should be useful in deciding the most economic method of reconditioning extensive areas.

Swamp Drainage.

Owing to the severity of the drought in Nyeri District, it was decided necessary to drain and reclaim the large areas of swamp land in the district. This work was carried out with the strong support of the Administration and in all 4,500 acres were reclaimed by the end of the year. The land in these swamps is very acid so that natives were urged to spread ashes over the soil obtained from the burning of Papyrus and Itanji reeds. Where this has been carried out very excellent crops of roots have been obtained. Most of these swamps have a fall of three to six in one thousand so that by the cutting of one large central drain and two contour drains, water was quickly removed. In order to obtain good plant growth it was found necessary to lower the water level by two feet from the surface.

There can be no doubt that the drainage of these swamps has greatly helped to save a situation bordering on famine. The soil is enormously rich in humus and with each season's cultivation its qualities improve. These swamps, under proper management, form great potential sources of wealth; similar drained land in Australia being valued at up to £100 per acre. Some idea of the value of the work carried out can be judged from the quantities of potatoes and maize which these rich lands are capable of producing each year. This amounts to 18,000 tons of potatoes and 32,000 bags of maize on a conservative estimate.

It is estimated that there are 10,000 acres of swamp land in Fort Hall District capable of being drained and on which work has already been commenced.

Native Agricultural Training.

This is carried out at the Scott Agricultural Laboratories and is reported on separately by the Deputy Director.

Main problems in hand for next year.

In addition to the many activities already under way and which will be maintained, the following problems will be tackled during the year :—

(*a*) *Soil Fertility.*—Although progress has been made in instituting remedial measures for recovering soil fertility, the loss of fertility is so widespread that powers will have to be sought to accelerate the work.

(*b*) *Soil Erosion.*—The reconditioning of large eroded areas.

(*c*) *Improvement in Quality.*—To improve the quality of maize, beans, beeswax, ghee and hides on a large scale.

(*d*) Improved facilities for marketing the above crops.

(*e*) Economic crops for various districts and zones within these districts.

(*f*) Best use for drained swamp land.

(*g*) Sufficient funds to carry out development work.

Miscellaneous Services for Development.

Transport.—Though comparatively little economic use is made of live stock in the Province at present, propaganda for the use of donkey and ox transport is meeting with rapid success. Donkey transport, especially, is increasing considerably. These animals with their renowned freedom from disease are eminently suited to native management. They are being successfully used for inter-row cultivation on seed farms and their use is being extended.

Live Stock.

With a population of from 200 to 600 per square mile it is apparent that the Akikuyu must eventually get down to the manuring of the land and the stall feeding of crops to obtain this manure. With this object in view, seed farms should be run on a mixed farming basis with the dual purpose of improving the milking capabilities of the native cow by selection and at the same time providing a local demonstration.

Poultry.

Work in the improvement of poultry continues to give good results through the issue of Rhode Island Red cockerels.

Breeding pens have been established at Fort Hal and Nyeri in addition to those already in operation at Meru, Machakos and Embu.

Hides and Skins.

Remarkable progress has been made, especially in Fort Hall, Nyeri, Machakos, Kitui and Embu districts, in shade-drying of hides and the assistance given by interested companies in Nairobi has been much appreciated. The industry was started by Government and Local Native Councils erecting hide-drying bandas and placing trained hide demonstrator instructors in charge. A number of natives trained under this organization have set up in the business on their own account and rail their shade-dried hides direct to exporters. The high percentage of first quality hides obtained by these natives point to their efficiency and to the lines on which general expansion should be encouraged. In most native districts in this Province, the work is under the charge of the Agricultural Officer.

Forestry.

Tree and fruit nurseries are run in conjunction with seed farms in all districts where there is no officer of the Forestry Department available for the work. It has been found necessary to impose a small charge for tree and fruit seedlings to insure their being attended to after issue. Wattle being by far the most useful all-round tree to the native, large plantings of gums are discouraged on valuable Kikuyu land suited to wattles.

Agricultural Shows.

Owing to lack of funds no wholly native shows were held during the year. The Kenya Agricultural and Horticultural Society, however, arranged for a native section at their show in Nairobi and exhibits were staged by this Department. Fort Hall natives easily led in the prize list.

Agricultural Development Zones.

Each district has been divided by natural conditions into agricultural zones and each zone is described on a sheet on which is listed all information of an agricultural nature appertaining to the zone. These zones are for the guidance of Government officers and missionaries working in the districts and insure co-operation and the striving after the same objectives in development. Directions for development are contained in the sheet.

Agricultural Implements.

Draught implements such as ploughs, cultivators, etc., are much used in the Machakos District but it cannot be said their use is much in evidence in the Kikuyu country. The factors militating against the use of these implements are the broken nature of the country and the system of land tenure with its stumbling block of fragmentation. Small light ploughs of Indian pattern were introduced towards the end of the year which can be easily carried from shamba to shamba.

The year has been a bad one for the agriculturist but it is encouraging to note the endless calls being made on all District Agricultural Officers' time by natives; pointing to a realization of the benefits of the services rendered and to an increasing interest in agricultural matters. Much of the extension work must necessarily be carried out by Native Agricultural Instructors who are gradually acquiring some sense of responsibility.

Relations with Administrative and Departmental Officers have been cordial and their co-operation and support is much appreciated.

W. G. LECKIE,
Agricultural Officer,
Central Province.

NYANZA PROVINCE.

Report of the Agricultural Officer in charge of the Province.

European Staff.—This consisted of four Agricultural Officers (including myself) and one Assistant Agricultural Officer. At the end of the year these officers were occupied in the following districts :—

Province : Mr. W. Lyne Watt.
North Kavirondo : Mr. T. Y. Watson.
Central Kavirondo : Mr. M. O. Graham (Asst. A.O.).
South Kavirondo : Mr. E. W. Gaddum.

At Bukura Native Agricultural School and Farm :—
Mr. J. E. Booth.

Central Kavirondo was shared between Mr. Lyne Watt (in addition to his Provincial duties) and Mr. Graham.

Native Agricultural Instructors.

	Dept. of Agriculture	L.N.C.	
Provincial Office, Kisumu	1	—	1
North Kavirondo	4	11	15
Central Kavirondo	5	12	17
South Kavirondo	7	—	7
Bukura School	5	—	5
	22	23	45

This is the first year in which the provincial agricultural administration has been used. In the short time it has been very conclusively proved that the method is sound. In previous years each Agricultural Officer was responsible to Nairobi and there was in consequence a great lack of uniformity in methods and also a failure to keep to a considered scheme. Young officers also found it extremely difficult to gauge the work in hand. Trade in the Province is largely worked from the larger business houses in Kisumu and supply and demand can be better followed by the officer stationed there and submitted to the district workers. As the scheme works, the Provincial Officer is stationed at the Provincial Commissioner's office and has therefore been able to keep in close touch with all Provincial matters relating to crops and other production.

It is interesting to note that the chiefs and people appreciate the instructors much more than they did in the past, especially in North Kavirondo where they decided to allot an increase in Local Native Council funds to provide for an increase of instructor staff.

Seasonal conditions, crops and pests.

The rainfall was not too seasonal, there being a heavy fall in January, taking the natives by surprise, then the big rains were late and uncertain, causing the planters to hesitate with their main cash crops.

In the short rains, there was a severe drought in November, just at the time when grains should have filled. On the whole, throughout the Province, rainfall was about 12 inches below average.

Crop Survey.

The year was commenced with a detailed scheme of cropping for the defined agricultural zones, and it was considered that with everyone conversant with the plant of "food crops" and "cash crops" for each zone, concentrated and accurate propaganda for better development would result.

This scheme certainly facilitated planting, harvesting and judging when cash was available in the reserves, but with the rains being unseasonal and spasmodic the increased areas of cash crops planted only yielded lightly in both seasons. Zone planting has proved of great value and has its advantages over the old haphazard methods.

The crops which received most attention were cotton, simsim, groundnuts and rice.

Cotton.—The 1932–33 crop, harvested in January–February, reached the record of almost four million pounds of seed-cotton. It was sold at the low price of Sh. 8 to Sh. 10 per 100 lb. of seed-cotton.

The annual totals since 1929 are given under "Increased Production".

The 1933-34 crop in Samia and North Kavirondo was planted in about July, 1933, with a shortage of rain. Spacing again improved slightly and more of the growing was better with the result that the quality of lint sold was the best on record.

Cotton planting was again encouraged in the Lake shore locations of Central and South Kavirondo; planting was advocated in March and April, but not till May and June were most of the natives persuaded to act. These Luo people take a keen interest in cattle and are apathetic about cash crops. Buying commenced on 30th October, with prices at the stores only Sh. 6/50 to Sh. 7 per 100 lb. of seed cotton, rising to Sh. 8 at the end of the year. Many natives refused to bother to pick their crops.

Groundnuts.—A very extensive seed issue was made amounting to 579 bags, most of which was given out in Central and South Kavirondo. The season was most unsuitable for our unskilled cultivators, the rainfall being low and the incidence of Rosette disease being very high.

The buying season commenced on 3rd September with the record low price of not more than Sh. 1/75 per frasila. With the price being low, many natives only sold a portion of their crop. Native growers in the new and old areas were reminded to keep seed for 1934, and their habit of eating the seed is the biggest adverse factor in the development of the industry.

Simsim.—The January–February harvest was an average one in quality and quantity. Increased plantings were made in September in all areas, but were droughted in November and a total light harvest is anticipated. Prices ranged from Sh. 2/50 to Sh. 2/30 per frasila at Kisumu.

Maize.—The August harvest was approximately 15 per cent below average, and quality better, but the September plantings, though very much a record, were droughted and in many places only yielded 50 per cent of average.

Prices ranged from Sh. 3/05 to Sh. 6 per bag at Kisumu.

Food and other crops.

The food situation was secure, though by no means too plentiful in the Lake shore locations. The higher proportion of root crops and bananas planted in past years did much to prevent distress, and in the more fertile locations these famine crops released more maize for sale purposes. Pulse crops should be increased throughout especially in the long rains season.

Plant diseases and pests.

Smut.—The *mtama* of the long rains suffered from smut to a greater extent than was observed in recent years.

Rosette disease in groundnuts was very severe and many crops were reduced by 75 per cent.

Striga Weed.—The infestation was the worst experienced in recent years and hundreds of natives had to be fined for failing to deal with it. They were apathetic and fatalistic.

Bhang.—A number of growers were discovered and fined.

McDonald Weed.—This is now becoming fairly common in South Tiriki and Maragoli.

Mexican Marigold.—One plant was found and destroyed.

Sugar cane mosaic.—This was not observed in the reserves.

Cotton stainers were very plentiful in the Lake shore locations.

Tobacco White Fly.—This was observed in some shambas.

Locusts.—Two swarms of migratory locusts passed through a part of the Province and did very little damage.

Vermin control.—Not only does one find that vermin, such as leopard, hyena, porcupine, hippopotamus, pig, squirrel, etc., do considerable damage to crops and stock, but the amount of land not put into production because of these is a very big item and war was declared on them, particularly in Central Kavirondo where Local Native Council funds were allocated for the purpose. The total number killed during the year was 3,067.

LOCAL NATIVE COUNCIL SEED FARMS.

As a result of the 1931 change of policy, the small demonstration plots were closed down and preparations made for opening one seed farm in each district.

Funds were made available and these farms are now established in Kakamega, North Kavirondo, Maseno, Central Kavirondo and Kisii for South Kavirondo.

The Kakamega land was covered with bush, Maseno with a solid mass of sisal and Kisii with bush. Clearing was particularly heavy in Maseno and to speed up the work a detention camp was built to accommodate one hundred natives. At the end of the year, the Kakamega farm had made most worthy progress and was in the short time a real asset to the district. In Maseno the soil is as yet very poor and will require heavy liming and manuring before it will yield crops. The Kisii farm has rather poor soil and is very wind-swept and until the tree shelter-belts are high enough progress will be delayed.

Farm	Area Cleared	Area under Crop	Planted with Trees	Total Ploughed end of Year
	Acres	*Acres*	*Acres*	*Acres*
Kakamega	40	30	—	36
Maseno	105	27	9	38
Kisii	50	18	13	40

The Agricultural Officer, Kakamega, was able to assist the District Commissioner with the management of the prison farm which has forty-two acres under heavy crops of maize, beans and potatoes, with another fourteen acres planted to gum trees and one acre of lucerne.

During the year each farm had the nucleus of a homestead built, consisting of maize cribs, tool and grain stores, cart shed and at Kakamega a model house for the instructor.

The Maseno farm was without any useful grazing and ten acres were cleared, ploughed and planted with a mixture of Star and Kikuyu grasses. A hedge was planted, and the paddock should be useful for night-grazing later on when more grazing land is required.

A large proportion of the arable land was put under Mauritius bean as a green manure and growth was satisfactory.

The object of these farms is to supply bulked samples of improved or new seeds, to demonstrate better methods, implements and stores and to supply tree transplants to the districts.

One of the objects aimed at is to train agricultural workers who will be selected from the districts, given farm work instruction for six months, then returned to their homes again.

The following crops were planted for bulking or observation :—

Tung oil, banana varieties, sugar varieties, essential oil crops, fruit-trees, ginger, groundnuts, bean varieties, linseed, potato varieties, maize, millets, etc.

Each farm has at least one battery of "Indore" compost pits which are giving satisfaction and will be increased in the coming year.

EXPERIMENTAL RESULTS.

Experimental work was carried out in Bukura farm, the three seed farms, Malakisi cotton plot, Kano Plains and Kendu plot. It should be realized that the Agricultural Officers can only spend a proportion of their time on the seed farms and plots and in consequence find it impossible to give adequate attention to these trials; nevertheless, in the absence of experimental stations, they are necessary.

Bukura Farm (4,900 ft.).

Field and crib selections of Muratha and Flat White maize, of soya beans, cow peas and Ih'umba sorghums. The latter is a popular white variety and the object is to find a strain which will be early and high yielding with a compact panicle.

Maize disinfected with Kerol for weevil control.

Pure kerol was sprinkled over the seed at the rate of 1 pint per 100 lb. The grain was then dried and bagged.

The germination after five months' bagging was not delayed but was only 85 per cent complete. The stored seed did not suffer from insect damage.

Pinto beans.—This did well in the short rains; dwarf growth; 87 days to maturity; yield 5½ bags per acre; little value as a soil-holding crop, but good food crop; slight nodulation; no disease.

Stizolobium alternium.—Green manure and cover crop; gave excellent bulk and is best used as a soil-holder; sets seed badly; few root nodules.

Calopogonium orthocarpum.—A first-class long-term green manure; primary value is as a cover crop; difficult to plough in; sets no seed and difficult to propagate.

Crotalaria axilaris.—Green manure and cover; good growth with bulk of beans borne compactly; upright, much branched; 2 to 2½ months to ploughing in; produces better bulk of vegetable matter but not as early as *C. Kirkii*; good seeder; recommended.

Crotalaria Kirkii.—Green manure and cover; 40–60 days to ploughing in; recommended as a short-term green manure.

W.D. Nyasa Tobacco.—Smoking and cash crop for natives; approximately three months to commencement of cutting; seeds made vigorous growth; a great improvement over present native tobacco; seed now ready for bulk issues.

Sweet Potato variety trials.—

Early Butter ...	4.9	tons of roots	per acre
Calabash Leaf ...	4.4	,,	,,
Uganda	2.6	,,	,,
Local Native ...	2.2	,,	,,

Eight months in all cases from planting of vines till harvest; the two imported varieties are valuable as stock-feed; the Uganda variety had heaviest bulk of leafage.

Citronella Grass.—From planting till the first cut, 9 to 12 months, subsequent cuts every 6 to 8 weeks in the rains; excellent soil holder if planted close.

Tephrosia toxicaria.—Insecticide; good leaf growth but tends to mildew; 5 months to first leaf cut, then every 6 weeks; of no use as soil holder or green manure.

North Kavirondo.

Cotton in Rotation.—The Agricultural Officer writes :—

"The rotation of cotton is being watched carefully and it is interesting to note that cotton crops following immediately upon Eleusine (finger millet) have been very prolific. Although the local Eleusine is scarcely harvested early enough for the same shamba to be put down to cotton in the same year it is here that the new K.E.R. Eleusine variety may prove its worth.

Again from observations made during the past season it is possible that on the richest soil it will pay the cultivator to partly exhaust the soil nutrients (by using a cereal or root crop) prior to planting cotton. Even during this last comparatively dry season, cotton grown in freshly broken virgin soil (in rich soil areas) had a tendency to grow to bush rather than to boll formation. Further observations are being made."

Cotton Variety Trial (Malakisi Plot) 1932–33.

VARIETY	YIELD PER ACRE		
	A. Quality	B. Quality	Total
	Lb.	*Lb.*	*Lb.*
1. Uganda S.G. 29	95	22	117
2. Malakisi Local	93	17	110
3. Uganda S.G. 27 : 15 : 13 ..	75	18	93
4. Nyasaland Over-the-Top ..	63	11	74

Lemon Grass.—Planting material obtained from Bukura Farm in May. At the end of the year growth had still remained slow and stunted. Results in the first year were not to be expected and work will continue.

Maseno Seed Farm (4,800 ft.).

Rice Variety Trials.—Eighteen varieties were put under trial. Only the following three were worth further trial and appeared to suit the cold position : —

1. Mumias.
2. Halkaduwi.
3. Mwanza Maji-Maji.

The Kano Plains Plot.

Cotton Planting. Optimum Date.—

Date of Planting	Yield per Acre	Remarks
	Lb.	
17th February	247	
27th March	305	
18th April	432	Made a very fine growth
18th May	229	
18th June	—	Failed with drought.
31st July	—	Ditto.
25th August	—	Ditto.
29th September	—	Ditto.
18th October	—	Ditto.

This has proved that late planting is useless in districts such as the Kano Plains and that heavy yields are assured when planting is seasonal and properly done.

Sorghum Variety Trials.—Twenty-four varieties were planted and some of the best are recorded below.

Name	Maturity Period	Yield per Acre	Remarks
	Days	*Lb.*	
Echisudi	144	800	
Feterita	127	560	
Ikhumba	152	495	Some smut effected crop.
Andiwa	128	467	
Nakhaloli	144	440	Set seed badly.

The crops experienced severe drought soon after germination and never recovered to normal condition.

Bulrush Millet.—The Department's bearded strain was obtained from the Coast Province and planted on 28th March. It made excellent growth and though never grown by the native in Nyanza, it has proved its suitability to our climate.

Period : 130 days.
Yield of grain : 1,480 lb. per acre.

Tepary Bean.—

Big rains crop—

Period : 76 days.
Yield : 760 lb. per acre.

Short rains—

Period : 54 days.
Yield : 818 lb. per acre.

Eleusine Millet (Wimbi) variety trial.

Variety	Period	Yield per Acre	Remarks
		Lb.	
Ndere	109	188	Droughted badly.
Odongo	118	—	Droughted.
Improved Kisii ..	99	814	Best yet found for short-period districts.

Otenashi Bean.—Grew well to start with, then was destroyed with leaf rust and only yielded 118 lb. per acre. No further trials to be made with it.

Cotton variety trials.—Sixteen varieties were tried; planted on 29th April, 1933; harvested on 30th September, 1933; spacing 3 ft. by 1½ ft. and one plant at each hole; vegetative growth was too luxurious; the six highest yielders are given below :—

Variety	Yield per Acre	Remarks
U/4/26/4	358	Grew well throughout.
Z/14	358	Bolls too numerous and small.
U/4/4/2	344	
U/4/64/7	344	
Local	317	Average of three controls.
U/4/4/10	316	

The S.G. (Uganda) strains were received late and were planted a month later than those recorded above but did not yield as high as the "Local" control.

Cowpea Variety Trials.—Twelve varieties were planted out but pods were eaten by birds and results unreliable.

Rice Variety Trials.—Fourteen varieties were planted. The six best yielders are given in detail below. Throughout growth of crop the water supply was insufficient.

Variety	Period	Yield per Acre	Remarks
	Days	*Lb.*	
Mwanza Sena ..	219	1,771	Tillered best of all.
Mwanza Maji Maji ..	214	1,560	Grew well when water was insufficient.
Maziwa	209	1,409	Sheds seed readily.
Mumias	209	1,248	Good upland variety.
Kisuki	214	1,147	Liable to break in hulling.
Bungala	209	966	Sheds seeds readily.

Kisii Seed Farm and Kendu Plot.

Rice variety trials at Kendu.—

1. Maziwa : failed.
2. Ambari : failed.
3. Bungala : 117 lb. per acre.
4. Kisuki : 218 lb. per acre.
5. Maji Maji : 3,630 lb. per acre.
6. Mwanza Sena : 3,388 lb. per acre.

New Crops.

NORTH KAVIRONDO

No.	Crop	Remarks
1.	Groundnuts ..	Introduced to Marach.
2.	Rice	Introduced to S. Kitosh with good results.
3.	Potatoes	Introduced to Maragoli; growth was satisfactory, potatoes of poor cooking quality and seed did not keep well.
4.	K.E.R. Wimbi ..	Bulked and issued in cotton country; very advantageous over old varieties.

CENTRAL KAVIRONDO

No.	Crop	Remarks
1.	Groundnuts ..	Started in new areas; planted too open and carelessly; suffered badly with rosette disease.
2.	Potatoes	Kerr's Pink grew successfully in N. Gem. Seed did not keep.
3.	Osema Gichore Sorghum ..	Proved to be early variety; good yielder; low growing; close headed; some bulking done natives calling for it.
4.	Ginger	Will do well in certain lake shore locations.
5.	Onions	Do well, but natives do not yet know cultural methods.
6.	Tung Oil	Rate of growth appeared to be very slow.
7.	Kapok	Grows well on lake shore.
8.	Rice	Development slow as natives want to treat it as mtama and percentage of failures due to droughting too high.

SOUTH KAVIRONDO

No.	Crop	Remarks
1.	Linseed	Very fine growth and yields. Dodder prevalent, no local market.
2.	Marrowfat Peas ..	The crop suits the climate in Kisii.
3.	Madagascar Butter Beans	Grew well; natives made good selective harvests. Difficult to sell.
4.	Canadian Wonder Beans	Natives find it a good crop.
5.	English Potatoes..	A very suitable crop of Kisii; seed keeps well; yields heavy; too remote for export market; natives not eating it much yet.
6.	Black Wattle ..	Suitable crop in Kisii; increased plantings.
7.	Fruit Trees ..	Mostly orange trees being grown.
8.	Vegetables ..	Natives more inclined to treat as a cash crop than as food.
9.	Wheat	In past years wheat was grown; improved strains now being introduced.

SOUTH LUMBWA

No.	Crop	Remarks
1.	Canadian Wonder Beans	This is likely to prove a good local cash crop, as well as an asset to the diet.
2.	Tung Oil	Results not yet known.
3.	Wattle	This is being fostered as a bark industry.

SEED ISSUES.

Tables giving particulars of quantities and kinds of seeds distribution obtained from Departmental sources, Local Native Council funds and seed-bulking farms, will be found in the Deputy Director's report.

IMPROVEMENT IN QUALITY OF PRODUCE.

In no previous year in the history of agriculture in Kavirondo did quality improve so markedly.

Cotton.—The quality of the 1932–33 crop improved considerably and is now considered by the foreign buyers as almost equal to Eastern Province, Uganda.

This has been attained by further education of the native producers, and by getting the ginners to be more selective in buying.

Groundnuts.—A very decided improvement was made in both South and Central Kavirondo. In gazetting the date for opening of buying, a clause was introduced prohibiting Grade II being sold during the first six weeks. This in itself did much to bring up the quality of sample.

In South Kavirondo all samples had to pass an inspector who supplied the owner with a ticket if quality was good. No buyer could receive nuts without the inspector's ticket.

In Central Kavirondo the responsibility for quality was put on the Indian buyer, who in turn was obliged to turn away all samples under standard.

It became so difficult for the producers to get rid of bad samples that many of the more lazy people declared that they could not plant groundnuts again.

Simsim.—The Simsim Rules were enforced and several buyers were fined in court for infringement of these rules. The crop had to pass through cleaning machines or over screens. Natives had to handle their samples in clean baskets or bags and the old system of dirty containers was completely eliminated. Never before was Kavirondo simsim of such fine quality and the big buyers appreciated handling the produce.

Maize.—This was attacked in three ways. Firstly the natives were pressed very hard to select white seed for planting which gave a superior purity at harvest time. They were forced to pick over their sale samples, all containers had to be clean and free from cow dung and they had to dry their samples before marketing. Secondly the Indian buyers were encouraged to cement their floors and verandahs, all had to own and use cleaning machines, and in South Kavirondo all samples had to pass the market inspector. The result attained exceeded expectations. Thirdly, no tax collection was carried out till the crops were ripe.

Beans.—A great improvement was made in North and Central Kavirondo, but in South Kavirondo where market inspection was done the purity and quality reached a high standard.

Other sale crops.—Though improved marketing methods were not enforced, it was evident that the natives gained a new habit as the result of restrictions in the above-mentioned crops and improvement was attained with green gram, vegetables, etc.

Increased Production.

This is extremely difficult to gauge in accurate figures with the exception of the cotton crop. The latter is as follows :—

1929–30	...	1,270,000 lb.	seed	cotton	bought
1930–31	...	918,967 lb.	,,	,,	,,
1931–32	...	2,166,352 lb.	,,	,,	,,
1932–33	...	3,940,764 lb.	,,	,,	,,
1933–34	...	6,499,244 lb.	,,	,,	,,

Other cash crops which were given special attention were : Simsim, groundnuts, maize, beans and green gram and though some were below average due to the drought, they would have been much worse but for our efforts.

Simsim.—A short-rains crop and was below average due to drought.

Groundnuts.—A main crop and suffered from rosette disease.

Maize.—A decided increase.

Beans.—The long rains crop was above average.

Green gram.—About average.

Marketing.

The principle followed with most crops was to use the present Indian buyers and enforce the marketing rules. In the trading centres where the buildings were poor and unsuitable, the owners in many cases were induced to improve them and a great many cemented the floors.

One large firm was given the exclusive buying right on the Nzoya River in North Ugenya for simsim, which is a very important cash crop in that region.

In Central Kavirondo weekly price lists were circulated to all chiefs and others interested in produce marketing so that the natives had a better idea of what they were doing.

The Agricultural Officer, North Kavirondo, writes :—

> "Since a number of Maragoli natives own water mills (almost forty by the end of the year with a total production of over one hundred bags of meal per day), it is hoped, in the near future, to obtain a percentage of the posho contracts on the mines, thus securing a local market for maize and maize products."

The Agricultural Officer, South Kavirondo, writes :—

> "Inspectors were appointed for trading centres. All native produce coming to the market must be passed by these inspectors and no sale allowed unless the seller produces the inspector's ticket, passing the produce as suitable for sale. This system applied to groundnuts, maize, simsim and beans."

In South Kavirondo two groundnut monopolies were given to important traders who bought in parcels of not less than ten tons and by this means the price was increased by twenty cents per frasila over the other system of selling by head-load quantities.

Native Markets.

These are well distributed throughout the Province and serve a very useful purpose for the local exchange of produce. Little improvement was made due to the difficulty of overcoming the present method whereby certain natives who may own the market place, or for some other reason, can make a handsome livelihood from toll paid to them by all natives selling produce there. The system is thoroughly unsatisfactory and will have to be changed.

Soil Fertility and Erosion.

The position is unsatisfactory and unless time can be spared to devote to the problem, there will be no marked betterment. In nearly all areas the rate of soil deterioration is very much greater than that of recovery.

The locust invasion of 1931–32 exposed great areas of soil to rain beat and caused very heavy erosion. It is thought that the loss from this secondary locust damage is greater than the initial destruction of crops and grass.

Natives are being pressed to contour-ditch, terrace with stones and bush, and to plant rows of live bunds to prevent storm water flow and retain soil moisture, but little short of special laws will attain the object.

Village manure lies rotting and burning where it is of no use, and in few cases can natives be persuaded to put this asset on the land. This alone would yield more crop and save the grazing areas for the cattle who can supply the children with more of the much-needed milk.

Land tenure will do much to furnish the solution of soil deterioration. In the meantime we have one small holding going which is worked in conjunction with the Bukura School and creating considerable interest amongst the natives of the district.

Grass and bush fires are still too common, except in Central Kavirondo, where they are prohibited.

Tree planting has increased tremendously, but leaves much to be desired.

Native Agricultural Training.

This is centred at Bukura and receives reference in the report of the Deputy Director.

Main Problems in hand for next year.

A scheme of work was prepared for 1934 with the object of acquainting the District Agricultural Officers, Administrating Officers and all other reserve workers who are engaged in the interests of these natives.

A few of the more important points are detailed below.

Almost every year there is a food shortage about May–June, that is before the big rains crops are harvested. To overcome this, certain crops have already been proved which will ripen early and cause much relief. They are *Osema Gichuore* sorghum, K.E.R. Eleusine and Tepary beans. These will be multiplied as rapidly as is possible.

Soil improvement is to be aimed at, control of soil and storm water and the use of manure.

Marketing improvement is to be vigorously continued.

Tree planting is to be speeded up considerably.

Seed Farms.—Cultivation to be increased and area of crops increased, buildings to be put up and roads improved.

North Kavirondo.—Groundnut planting to be encouraged in Marach.

Cotton.—Trial plantings to be made in Waholo, Wanga and Mumias with a view to large scale plantings being made in 1935.

Tree planting to be concentrated in the gold mining areas.

Central Kavirondo.—Concentration with Agricultural Officer and Instructors in Zone III, cotton, groundnuts, simsim and kapok and soil control to receive special attention. 1,300 frasilas (2 tons) of groundnut seed to be issued.

Tree planting concentration in Sagam and East Kano is to receive attention.

An experimental plot in Kano Plains is to be opened.

South Kavirondo.—Cotton is to be undertaken on a large scale in Karachonyo, Kanidda, Koojia, Gem and Mumbo.

Coffee; part of the 100-acre planting is to commence.

The wattle industry is to be encouraged in the Kisii Highlands.

South Lumbwa.—Wattle industry; increased plantings in Belgut and Buret.

Maize growing is to be increased to meet the growing demand.

Grazing and arable areas are to be marked off.

Bean growing is to be increased.

GENERAL.

No Agricultural Shows were held in the Province on account of economy but all districts took part in the native section of the Nairobi Show in December and North and Central Kavirondo gained a satisfactory percentage of the prizes.

Local Native Councils have again taken an added and practical interest in our efforts. In spite of the shortage of cash, council funds for agricultural work were increased.

Methods of cultivation improve slowly and particularly with the cash crops; they are far from satisfactory.

Transport methods improve rapidly. The Butere–Kisumu branch line has been a great asset. Roads were never so good. Natives in the Kimilili region of North Kaviondo have been buying ox carts and waggons and those of Maragoli were forced to buy motor lorries on account of oxen and grazing shortage. In Central Kavirondo and South Kavirondo some of the natives have commenced to use pack donkeys and the increase in numbers is likely to be rapid.

It cannot be too strongly stressed that though progress is steady and systematic, it could be economically speeded up with additional staff.

APPRECIATION.

It is desired to record the appreciation of the Provincial and District Agricultural Officers concerning the great assistance rendered to them by the Administration and other Departments during the year under review.

W. LYNE WATT,
Agricultural Officer,
Nyanza Province.

COAST PROVINCE.

REPORT OF THE AGRICULTURAL OFFICER.

Staff.

Mr. C. O. Oates took over from Mr. N. Humphrey, who proceeded on leave in March. It was only found possible to post one officer to the Province. The station is Kibarini, near Kilifi.

Mr .P. Booth assisted with the cotton campaign and was in Malindi sub-district from April until August.

Mr. Oates' work was mainly confined to the Kilifi and Digo Districts but safaris were made to Lamu, Tana River and Voi Districts.

Seasonal Conditions.

The rainfall was well below the average. The long rains were late and very scanty, with long intervals between each fall; there was just enough to grow a crop in the coast strip but in the hinterland they failed completely.

The short rains were also late and failed completely in the coast strip, in the hinterland they started well but finished by the middle of December, causing a second crop failure.

The rainfall record at Kibarani was 34.80 inches. Of this eight inches fell in January and five inches during August and September, three months when rain is not really needed.

Crops.

The year 1933 was the worst cropping year the Coast has experienced for some time. From the long rains planting a small crop of maize was reaped in the coast strip; in every other locality maize failed. In the short rains maize failed everywhere. Cow peas, pojo and simsim did fairly well in the coast strip but failed elsewhere.

A crop of mtama was reaped after the long rains on Wasin Island, and also on the Bajuni coast. These places are at the two extremities of the Kenya coast.

The Vanga rice coast was disappointing, whilst on the Tana River only at Kau was a good yield obtained.

The cultivation of cassava was again extended and proved its value in a year of food shortage. Whilst there is no doubt that cassava does impoverish the soil, it will be a very long time before the Coast can afford to do without it.

Sugar plantations suffered from drought as the fields which were cut only "ratooned" very slowly. The Java varieties P.O.J. 2878 and 2727 have done very well at Ramisi, the return of sugar per ton of cane being much higher than other varieties.

All the sisal estates in the Coast Province are operating and more labour has been engaged on their cultivation. During the year Kuruwitu Estate, Teita Concession and Taveta Estate reached the cutting stage.

The cashew-nut industry took a great step forward during the year under review. Machinery for roasting the nuts was imported by Mr. W. G. Lillywhite and a factory erected at Kilifi. During the early part of the year over 150 tons of nuts were purchased at the buying posts in Kilifi and Digo districts. These nuts are now being roasted, cracked and skinned. A trial shipment has been sent to the United States of America and it is hoped that a lucrative trade will be built up. A vigorous planting campaign was continued during the long and short rains and some thirty thousand seeds were planted. Owing, however, to the unfavourable season it is feared that a great number of seedlings died.

Cotton Crop 1932–33.

This crop was a record for the Coast, the final figures being :—

Seed cotton bought—A quality ...	943,635 lb.
B quality ...	139,191 lb.
Total ...	1,082,826 lb.

Cotton Crop 1933–34.

The area under cotton was again considerably extended in 1933. With the rain failing inland, however, quite half of the "shambas" died or the seed failed to germinate. It had been hoped that the amount of cotton obtained would double that of the 1932–33 crop. This was not to be, but it is gratifying to report that despite the adverse year an increase in the output of seed cotton grown did take place.

Buying opened on November 6th and up to the end of the year* the following amounts of seed cotton had been purchased :—

Grade A ...	970,630 lb.
Grade B ...	230,582 lb.
Total ...	1,201,212 lb.

Of the above 860,002 lb. went to the Malindi Ginnery, 332,210 lb .to the Mazeras Ginnery.

The percentage of Grade B is very much higher than usual; this is due to two causes, the adverse season, which made a great deal of the cotton in the hinterland dry out and go brown, and the fact that cotton had been grown by a large number of natives for the first time. These people were scattered over a very wide area which made it impossible for the instructors to show them all how to harvest and sort their cotton. Also, even when the Wanyika did know how to sort the cotton many of them were too lazy to do so, preferring $3\frac{1}{2}$ cents for Grade B rather than sort their cotton and get 8 cents for Grade A.

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*Purchase of the 1933–34 crop was not completed till February, 1934. Subsequent to the preparation of this Report a final return of 1,439,219 lb. of seed cotton was received.

In the coast strip only about 7 per cent of the cotton was Grade B.

Owing to the unfavourable weather conditions the lint was not strong and the cotton seed was light. This latter factor put up the ginning out-turn to nearly 32 per cent.

Sh. 9 per 100 lb. was paid at the ginnery and within twelve miles, whilst Sh. 8 per 100 lb. was paid at the buying posts.

The new ginnery of Messrs. the Coastal Ginners, Ltd., was opened at Mazeras in November.

Marketing.

Permanent stores were erected by the Malindi ginnery at Mabrui, Marafa, Goshi and Kakoneni during 1933.

The Coastal Ginners erected a permanent store at Chonyi and had temporary buying posts at many centres in the Kilifi cotton area.

The proper organization of cotton and cashew nut buying assists in bringing approximately Sh. 110,000 in actual cash into Kilifi District (with Malindi), quite apart from the money spent in preparing these commodities for market.

The Malindi ginnery is now purchasing kapok at the same time as cotton and hopes to do the same with simsim.

The building of permanent stores in the Native Reserves opens up great possibiltiies for the further organization of the marketing of produce in a good year. Up to the present in the Coast Province maize and other produce has been stored in dilapidated sheds at the back of dukas until it is ruined by weevils, then it is taken out and sold.

Communications.

The Mombasa–Kilifi road is now better than it ever has been, whilst the south coast road has been improved.

The Malindi–Kilifi road is bad, but it is understood that it is to be repaired in the near future.

The Malindi–Tana road was improved during the year, whilst it is hoped to get the road through from Garsen on the Tana River to Lamu early in 1934.

Owing to the unsatisfactory nature of the dhow transport and the impossibility of getting produce insured when in transit in this way, the roads at the Coast are becoming of increasing importance.

Seed Farms and Seed Issues.

During the year the Department undertook to do seed bulking at Kibarani for the Kilifi Local Native Council. An area of approximately seventy acres was obtained from Mr. W. Lilywhite which was put under maize, sorghum, millet and cowpeas.

It was a very unfortunate year for seed bulking and about ten acres failed completely; however, Kilifi district obtained the following seed :—

	bags
Durum maize	55
Yellow Menando maize	50
Bonganhilo sorghum	10
Tepary beans	8
Cowpeas	10
Bulrush millet	5
Black gram	5

The Kwale seed farm had a successful year despite the drought, though the yields were naturally not heavy. The interest taken by the Administrative Officers in this farm is very gratifying. The District Commissioner was personally responsible for erecting a very fine store.

The following seeds were issued to Digo District from Kibarani :—

	bags
Muratha maize	30
Yellow Menando maize	20
Tepary beans	2
Cowpeas	7
Foxtail millet	1
Pigeon pea	1

Three bags of Durum maize were sent to Garissa, three bags to Marsabit and two bags to Major Layzell at Taveta for bulking purposes.

For the short rains planting altogether 213 bags of seed were issued from Kibarani and thirty bags kept back for the long rains and for seed purposes.

About ninety acres of crops were planted during the short rains but at the moment of writing this report there appears to be little chance of the crops maturing.

Apart from the above over a hundred tons of cotton seed was issued in the Malindi cotton area, and about ninety tons in the Kilifi area.

Experimental Work.

Adverse weather conditions made 1933 a very difficult year for experimental work. On only one occasion was it possible to plant for three consecutive days, and many plots were planted three times with no result.

Maize.—The varieties Durum, Yellow Menando and Muratha, having proved themselves, were bulked on a large scale.

Several imported American varieties were tried in the smaller plots, none of which, however, reached maturity, all dying of drought.

A ridge versus flat-planting trial was definitely in favour of the ridge planting.

Sorghums.—Bonganhilo proved to be the best sorghum under trial, and when bulked on a large scale gave a heavier yield per acre than any other crop at Kibarani.

The Kavirondo sorghums were given up owing to their unpopularity with the natives, who, however, were very enthusiastic about Bonganhilo.

Dwarf Hegari was again tried but unfortunately caught a very dry spell.

Bulrush Millet.—The Tanganyika awned strain was tried on a large scale and found to be very satisfactory. It is being further selected for its awned characteristic.

Cassava.—Trials were continued for mosaic disease resistance. The following varieties were tried :—

Aipin Mangi (Java).
Binti Athmani.
Karokote (Jibana).
Seychelle.
Bwana Humphrey (Malindi).
Mwabaya Nyundo.

All became infected but the Karokote and Bwana Humphrey varieties to a lesser degree than the other. These two varieties gave the heaviest yields, but Binti Athmani gave a heavy yield although heavily infected. This trial will be continued.

Groundnuts.—A supposedly resistant American variety Alabama Runner was tried but every plant became infected by wilt disease. A greater degree of resistance was shown by the Kavirondo variety and seed was obtained from some twenty-five plants that showed no signs of wilting.

Simsim.—Owing to the bad season no conclusion could be drawn from the simsim trials.

Pigeon Pea.—The New Era variety yielded heavily in a very bad year, whilst newly planted plots stood up to the drought well.

Tepary Beans.—As reported elsewhere this was bulked and issued. The drought resistant qualities of this bean continue to excite wonder.

Cotton.—The following varieties were tried :—

Old Malindi.
S.G. 29. Once grown at Kibarani.
U/4/4. From Tanganyika.
Over-the-top. Once grown at Kibarani.

The best varieties were U/4/4 and S.G. 29 which will have a large scale trial in 1934.

Green Manure and Cover Crops.

Two trials were laid down, one in April of seven varieties, and another in June of four varieties. Although the April trial was twice replanted the only crop to establish itself was the sword bean. In the June trial the black Mauritius bean (*Mucuna atropurpurea*), *Dolichos lablab* (*Fiwi*) and *Clitoria* sp. were the most successful. On the year's showing the black Mauritius bean should be a very good crop for the Coast. *Canavalia obtusifolia* again did well but seed is practically impossible to obtain.

Other Crops.

The fruit trees planted in 1931 have done well at Kibarani. The Indian and Java almonds have produced fruit some of which has been planted and this has germinated.

The West African oil palm is doing well at Kibarani and a new drive has been planted with this palm.

Sunflowers again did well but there appears to be no chance of establishing a regular market for them.

Kapok is also doing well.

General Progress and Development.

Since 1931, with one Agricultural Officer at the Coast, the cotton area has been doubled and the area under crops at Kibarani, for bulking purposes, quadrupled. As all this work has had to be supervised by one officer the experimental work has not had that close supervision it required. It was necessary for Mr. Oates to spend 128 days, out of the 292 days that remained in 1933 after he took over, on safari, this despite the fact that he had 150 acres under crops, both being experimented with and bulked, to look after.

With the advent of a second Agricultural Officer in 1934 it should be possible to give much closer attention to the essential work of experimentation.

A programme for the gradual introduction of proven drought-resistant food crops throughout Kilifi and Digo districts was inaugurated in 1933 but the drought prevented the issues of seed from having the effect they would otherwise have had.

Cotton cultivation was extended in Kilifi district, whilst it was introduced into Lamu for the first time for many years on a commercial scale. In 1934 it is hoped to extend its cultivation to the greater part of Digo district and some parts of the Tana River district.

The organized marketing of cotton and cashew-nuts proceeded satisfactorily; organized marketing is the only way in which the early states of such industries can be fostered.

The possibilities of the Dom palm nut for vegetable ivory are being explored; other possible export crops have been considered.

During the year the Umba River valley was investigated for its irrigable possibilities and another irrigation scheme at Taveta was reported on.

Soil samples were taken on the Tana River in preparation for the visit of the committee of investigation early in 1934.

Conclusion.

Despite adverse weather conditions 1933 was a year of definite progress at the Coast. The Department has now definite lines to work on and the limiting factor of progress is the lack of European staff.

The relations between the Agricultural Officer and the Administration are excellent.

C. O. OATES,
Agricultural Officer,
Coast Province.

PLANT PEST AND DISEASE PREVENTION.

Coffee.

This crop came generally under the operation of the Diseases of Plants Prevention (Coffee) Rules, 1932, which consolidates rules aimed at (*a*) the prevention of new introductions of pests and diseases by regulating the importation of coffee plants and seeds, (*b*) inspection of plantations to ensure adequate crop sanitation, especially for the control of *Stephanoderes* and *Sophronica* and (*c*) inspection and certification of coffee intended for seed. A system of licensed warehouses permits supervision of the disposal of the crop under adequate safeguards against dissemination of pests and diseases.

Although Rules were gazetted in 1932 to enable prohibition of the movement of plants liable to carry a pest or disease from one area to another, no "closed areas" have been declared up till the end of 1933, but a prohibition of movement of plants from the coffee mealy bug areas to clean coffee areas is to be enacted in 1934.

During the latter part of the year a further attempt was made to have neglected plantations uprooted or put into a proper state of cultivation since, in a neglected state, they are a danger to neighbouring plantations. Only one Plant Inspector was available for the work but some 900 acres have been up-rooted and other owners are doing their best to clean up the plantations they intend to keep under cultivation.

Sugar.

Mosaic disease.—Regulations in force during the year for the control of mosaic disease included general quarantine of the affected area in Nyanza Province to prevent movement of diseased material to other parts of the country. Re-introduction of planting material of the susceptible Kampala variety from native reserves into the non-native areas of Nyanza Province was also prohibited and Kampala cane was ordered to be eradicated from all non-native sugar areas in Kisumu–Londiani district.

Mosaic disease appeared in some eighty acres of the susceptible varieties at Chemelil and also in small nursery patches of the Kampala variety. Diseased canes in these susceptible varieties were rogued out in an attempt to control the disease, but it is doubtful whether such measures will have any permanent effect whilst susceptible varieties are in use and the possibility of complete and permanent eradication of mosaic by legislation in respect of susceptible varieties is now being re-considered. Fortunately the considerably increased acreage now under varieties immune from or highly tolerant of mosaic have greatly improved the position in regard to the disease.

Maize.

Striga Weed.—A campaign against striga weed was carried out as in previous year in the Kisumu–Londiani area under powers conferred by the Diseases of Plants Prevention Rules. The campaign was organized under somewhat different lines from previous years with less onerous duties on the Honorary Inspectors and successfully achieved its purpose of ensuring active measures against striga weed. The Plant Inspector reported that due, in part at least, to the lessons of previous campaigns, nearly all concerned made consistent efforts to destroy the parasite before it could set seed. Only one prosecution was instituted during the season, a conviction being obtained.

General.

Further details of services for plant pest and disease prevention will be found in the reports of the Entomological and Mycological sections. There is need for uniformity in legislation through East Africa and this question is to receive attention at a Conference to be held at the Amani Research Institute early in 1934.

EXTENSION WORK.

The advisory services of the Division have come into increasing demand with the depression and with the widening scope of its investigational and field work for meeting urgent practical problems. Officers attend meetings of Farmers'

Associations on invitation to deliver addresses on current problems, and see many individual farmers during the course of the year, as well as reply by correspondence to a large number of enquiries. In one direction the extension work is now taking an organized form; this is in the establishment of Farmers' Days in addition to the usual Agricultural Shows.

Nakuru Show and Farmers' Days.

A one-day Agricultural Show was held at Nakuru on the 9th March under the auspices of the Royal Agricultural and Horticultural Society of Kenya. The Plant Industry Division of the Department staged a comprehensive exhibit depicting the work of its various sections. This included a display showing the main pests of the Rift Valley Province by the Entomological Section, and the diseases affecting the cereal crops of the Colony by the Mycological Section. The Chemical Section staged exhibits of soil profiles, essential oils and pyrethrum. Green manures and cover crops spray materials, root systems of coffee trees and the work being conducted on the vegetative propagation of coffee, showing grafted trees and cuttings, were exhibited by the Coffee Section. A mixed farming exhibit was staged by the Plant Breeding and Experiment Services of the Rift Valley Province in conjunction with the Animal Husbandry Officer. This large display included progress exhibits on the Department's wheat and maize-breeding work, an exhibit of marrowfat pea varieties and methods of harvesting and preparing them for market; linseed varieties, English potato varieties; the grading and packing of eggs, good and bad fleeces and hides, good and bad ghee and butter, good and bad sides of bacon, etc. The opportunity was also taken of showing maize seed from the winning competitors in the Maize Seed Competition. The Agricultural Officers working in Native Reserves staged a fine display of native products which clearly demonstrated the improvements being effected by their efforts. The Department is indebted to the Natal Tanning Extract Company and to the East African Sugar Distributors, Ltd., for the display of their products.

On the following day a Farmers' Day was held in a shed on the Nakuru Showground, by kind permission of the Royal Agricultural and Horticultural Society. Lectures were given by officers of the Department, the Plant Industry Division being represented by Mr. Lathbury, who spoke on "Diversified Crop Farming", and Mr. Maher, who dealt with the Maize Seed Competitions, taking the results of the competitions of the past year as an illustration of the value of these.

Coffee Planters' Day.

This was held at Nairobi on October 25th, prior to the opening of the Coffee Conference. Lectures were given in the morning to a large audience. The Senior Entomologist reviewed some of the major entomological problems of the Colony and explained the administrative action being taken to deal with certain pests. The Senior Coffee Officer read a paper on general coffee culture, illustrated by lantern slides. This resulted, as was intended, in a general and informative discussion on the subject, in which many coffee planters took part as well as officers of the Chemical Sections of this Department and of the Department of Agriculture, Uganda. A résumé was also given of the Division's work on Coffee Berry Disease.

During the afternoon parties of planters were taken on a tour round the Scott Agricultural Laboratories to see for themselves the experimental work on coffee in progress there.

Nairobi Show.

The Department of Agriculture staged exhibits at the Agricultural Show held at the Nairobi Show Ground at the end of December under the auspices of the Royal Agricultural and Horticultural Society of Kenya. Apart from the exhibits of some of the specialist sections the Departmental exhibits, as a whole, followed rather different lines from those of former years.

The Entomological and Mycological Sections displayed an exhibit of the pests and diseases common to the country. The Agricultural Chemical section displayed a number of qualities of different kinds of essential oils and also a comprehensive exhibit of pyrethrum intended to show the proper time of picking the flowers and the method used for extracting the pyrethrin; both essential oils and pryrethrum are likely to become important side-lines in European agriculture. The Soil Chemist prepared a number of soil profiles taken from various parts of the Colony in order to demonstrate the nature of the soils they were farming on and the treatments required.

The Coffee Section displayed samples of soil types of which coffee is grown, taken from both this and other countries; green manure and cover crops found successful in various parts of the Colony were also shown as were the various methods of pruning on the multiple-stem system, the different methods of vegetative propagation under trial during the year and the effect of Carbide and Bordeaux sprays on the leaves. There was also a large display of graphical reproductions of root systems taken from trees in various parts of the country where roots had been washed out, demonstrating the surface and lateral climatic conditions as well as various manurial and cultural treatments.

The Plant Breeding Services, the Animal Husbandry Officer, the Grassland Improvement Officer and the Agricultural Officers of the Trans Nzoia and Nakuru Districts combined together to display a varied mixed farming exhibit suitable for the different areas of the Colony. This exhibit included a number of new rust-resistant wheats, a demonstration of disease-resistant and otherwise desirable kinds of maize compared with poor types of maize, a demonstration of good and bad qualities of animal products, a number of pure and mixed grasses, cut from trial plots, which should be given an extended trial in the different areas of the country, and a wide range of cash and green manure crops which have proved successful in various parts.

The Chief Grader and Inspector brought up from Kilindini typical samples of the produce (chiefly maize and beans) which passes through his hands, placed in their different grades. He also graded a number of samples of maize which had been collected by Agricultural Officers so that farmers could see for themselves the effect the amount of different defectives had on the grade into which maize was placed. An interesting exhibit was provided by a farmer who showed a bag of maize shelled straight from the stook into the bag, which was graded as being "undergrade"; the same farmer produced a bag of maize into which he had not shelled his badly pink ear-rotted cobs. This latter bag of clean maize was graded first class K.2 and was simply the result of not shelling into it the diseased 5 per cent of the crop. This exhibit went a long way towards impressing upon farmers one of the simple ways of preventing deterioration in the quality of maize exported, that is, by exercising a little care not to shell badly rotted cobs into their export bags.

The Plant Industry part of the Native Exhibit followed quite different lines from that adopted in former years, in that rival exhibits from the three main provinces were not displayed, since the produce from each must necessarily be different and cannot be compared. Instead an exhibit was made of all products grown in native reserves and a good and bad sample of each was prepared with the market price of each quality clearly displayed. Native peasants could thereby see the value of carefully cleaning and preparing each product before offering it for sale, and merchants and others could see what really high-class produce could be exported from the reserves instead of the often indifferently prepared articles which are offered.

It will be seen that the Plant Industry Division's exhibit was an educational one and that an attempt was made to teach both Europeans and Africans the value not only of growing the best varieties of a crop, but also of preparing their produce in such a way as to command the highest price.

During the period of the show parties of natives, who had been specially brought down by the Administration from the native reserves for the purpose, were personally conducted over the Native Agricultural Exhibit and round the small-holding at the Scott Agricultural Laboratories in order to see for themselves how best to make use of their land and how to prepare their produce for the market. It should be added that the Plant Industry Division's exhibit was part of a larger combined educational exhibit prepared in collaboration with the Animal Industry Division and with the Medical and Education Departments so that the conducted parties of natives, chiefs and headmen, were given a very comprehensive idea of how to improve the social and economic conditions of their people.

PLANT INDUSTRY.

Publications.

Bulletins.

"Observations on some Pasture Plants of Kenya," by D. C. Edwards, B.Sc., Agric. (Bulletin No. 1 of 1933).

"Trials of Cash Crops and Green Manure Crops in the Nakuru and Kitale Areas during 1932." By the Staff of the Plant Breeding Station, Njoro, and the Agricultural Officer, Kitale (Bulletin No. 2 of 1933).

"Maize Yields and Green-Manuring, 1932, including a Report on the Maize Seed Competition, 1932. By C. Maher, M.A. Dip. Agric. (Cantab.), A.I.C.T.A., Agricultural Officer (Bulletin No. 3 of 1933).

"The Control of Antestia in Wetter Districts; Notes on a Paraffin-Pyrethum-Soap Emulsion Spray." By F. B. Notley, B.Sc. (Hons.), A.I.C.T.A., Entomologist. (Bulletin No. 4 of 1933.)

"The Growing of Wattle and Production of Wattle Bark in Kenya" (Revised Edition). By W. G. Leckie, B.Sc., Agricultural Officer. (Bulletin No. 5 of 1933.)

Leaflets, Press Articles, etc.

"Storage of Maize and Treatment for the Destruction of Weevils." By the Entomological Section.

"Markets for Kenya Produce in British India and Ceylon." By V. Liversage, B.Sc., M.Sc., N.D.A., Agricultural Economist.

"Danish and Kikuyu Food Production Compared." By V. Liversage.

"Prices of Kenya Coffee in Relation to Production." By V. Liversage.

"The Tenure of Native Land." By V. Liversage.

"Two New Records of Physiologic Forms of Stem Rust In Kenya Colony." By J. McDonald, D.F.C., B.Sc., F.L.S., Senior Mycologist. (Published in "Transactions of the British Mycological Society, XVIII., Part III, December, 1933.)

"Hard Seeds in *Panicum coloratum* Stapf." By D. C. Edwards. (Published in "Nature" Vol. 132, No. 3327, p. 209, 1933.)

"The Biology and Control of *Asterolecanium coffeæ* Newst. "The Fringed Scale of Coffee in Kenya Colony." By H. C. James, Ph.D. (Published in the "Bulletin of Entomological Research," Vol. 24, part 3.)

"Taxonomic Notes on the Coffee Mealybugs of Kenya Colony." By H. C. James, Ph.D. (Published in the "Bulletin of Entomological Research," Vol. 24, part 3.)

"Field Spraying with Undiluted Paraffin Extracts of Pyrethrum against *Antestia* and *Lygus* on Coffee in Kenya." By R. H. Le Pelley, Ph.D. (Published in the "Bulletin of Entomological Research," Vol. 24, part 1.)

ACKNOWLEDGMENTS.

It is felt that the year has been one of substantial progress in improvement of crops and methods, if not in increased production (due to the drought and the depression), in accordance with clear aims and purposes, supported by whole-hearted effort on the part of a hard-working team of specialist and field workers whose work is of high quality. A pleasing feature of the field work of the Department is now the unremitting assistance of Administrative Officers, particularly in the Native Reserves.

H. WOLFE,
Plant Industry Division.
Deputy Director,

ENTOMOLOGICAL SECTION

REPORT OF THE SENIOR ENTOMOLOGIST

Staff.

Mr. Wilkinson, with Mr. Cottington as assistant, remained seconded in charge of the Coffee Berry Disease investigations in Sotik.

For part of the year, Dr. James continued his work on the coffee mealy-bugs but went on leave, pending retrenchment, on the 27th August.

Dr. Le Pelley returned from leave in January and, with Mr. Naismith Jones as assistant, established a field station at Kasarini for a detailed study of *Antestia* and its control.

Mr. Notley went on leave on the 24th November. He initiated various lines of research work at the Scott Laboratories which will be continued on his return.

Administration.

During the year 2,184 letters were dealt with; 171 permits for the importation of plants were issued; 148 certificates were issued for the domestic movement of plant material or for overseas; over 800 coffee trade samples were dealt with; 582 specimens of insects and plants showing insect damage or suspected insect damage were examined, reports submitted or advice given; 585 packages of plants and seeds, arriving by post, were examined, in addition to the consignments inspected at the port of entry. The following is a summary of the imports of plant material during the year under review: Citrus, 2,173; deciduous fruits, 9,339; grape vines, 10,549; bush fruits, 2,309; bulbs, 29,129 plus 50 packages; garden plants, 3,064 plus 58 packages, seed packages, 12,452; miscellaneous, unclassified, 5,311.

Neglected Coffee.

During the latter part of the year a further attempt was made to have neglected plantations uprooted or put into a state of cultivation. Wherever possible it was the aim of the inspector to have such work done without resorting to legal action unless absolutely necessary. Each case had to be judged separately and although the ultimate object was either to uproot the coffee or have it cleaned up, the methods adopted were necessarily often widely divergent. In the case of some twenty-five estates pressure was brought to bear on the owners or agents and approximately 900 acres were uprooted. On many other estates the owners were doing the best in their power, with the means at command, to clean up. Again other estates were reported as neglected but, on inspection, it was found that there was no foundation for such reports. There has been little opportunity for systematic inspection but as much as possible has been done under the present circumstances.

INVESTIGATIONAL WORK.

Mealy-bug.

Dr. James continued his work on the mealy-bugs of coffee until he left the Colony in August. Fortunately, owing to the climatic conditions obtaining, this pest has been in abeyance for the greater part of the year. No control, other than the banding against attendant ants, has been evolved. Predators have done good work but this is spasmodic and has not been so successful as was expected. Indigenous parasites are almost entirely absent and the few which have been found can play a very small part, if any, in the control. A determined effort to introduce parasites of the coffee mealy-bug has been initiated and, with the help of the Farnham House Laboratory, as many as possible of the mealy-bug parasites introduced into California will be tried here as it is just possible that some of these might be useful against *lilacinus*. It is too soon to give further details but it is hoped that one of the staff of Farnham Laboratory will be seconded for a time to undertake this work.

Pseudococcus lilacinus, Ckll., is still confined to the coffee areas of the Central Province, in which area it has been recorded from some eighty host plants including the chief field and garden crops.

Pseudococcus citri, Risso, is to be found in most of the coffee areas of the Colony and is of minor economic importance. "n addition to the strain of *P. citri* which occurs on the aerial parts of coffee, there is also what appears to be a biological race which is confined to the roots. Although it is morphologically indistinguishable from the foliage-infesting form, repeated experiments have shown that it cannot be induced to live on the leaves or other aerial parts of *Coffea arabica*. Even individuals, hatched from eggs placed on the foliage, which thus have not had an opportunity of feeding on the roots, fail to accustom themselves to this new situation.

There are differences in the waxy patterns of the dorsum in the root and aerial forms, the median longitudinal groove of the aerial form being absent in root-infesting individuals. The writer, however, is aware of the danger of basing conclusions entirely on differences of the secretionary covering of these insects, and the distinction observable may be due entirely to differences of habit.

The coffee root-infesting mealy-bug sometimes occurs in association with a fungus whose compacted mycelia in advanced stages completely invests the mealy-bugs. In other cases, which were for the most part confined to very young plants in coffee nurseries, no sign of the fungus could be detected. There seems to be a distinct correlation between excessive dampness of the soil and the incidence of coffee root mealy-bug in Kenya, and there is only one record in which this condition did not obtain. The foliage of an infested tree turns yellow, and where the mealy-bugs occur with the fungus they are capable of killing the host. Although the *citri* forms of root mealy-bug are widely distributed in East Africa on coffee and other hosts, the damage they have inflicted has never been sufficiently great to entitle them to more than the status of a minor pest. James (*Bull. of Ento. Res.*, Vol. XXIV, p. 429.).

DR. LE PELLEY'S REPORT.

Antestia.

The work during the year consisted of a detailed study of *Antestia* and its parasites and the conditions influencing the severity of attacks by this insect. For this work I equipped a field laboratory and meteorological station on Kasarini Estate and I have to acknowledge much help from the Director of the British East African Meteorological Service. From April until the end of the year I had the assistance of Mr. Naismith Jones, and during this time he was called upon to make a number of inspections in Makuyu, Thika, Kiambu and Limuru, for the Central Agricultural Advances Board and the Land Bank.

Experimentation on control measures against *Antestia* was undertaken which was unfinished at the end of the year. The results obtained, however, indicated the superiority of pyrethrum-kerosene extract spraying over the other methods tried. Practical big-scale applications of this spray, it has been noticed, often suffer from inadequate supervision, which markedly reduces their efficacy.

Data on the incidence of parasitism; on the rise and fall in the severity of *Antestia* attacks; on the influence of weather conditions on the insect; and on a number of other correlated points were obtained and this work is to be continued over an adequate period.

Antestia attacks of extreme severity were experienced in Kiambu and this bug was the most serious pest in the district during the year. Mealy-bug was generally less troublesome than usual. *Lygus simonyi* was a minor pest only, almost certainly consequent on the paucity of intermittent flowerings. The prognostication previously made that when weather conditions should influence the coffee to produce two main flowerings, without intermittent flowerings, *Lygus* would cease to be of major importance, was fulfilled.

Two visits were paid to Nyeri, two to parts of the Rift Valley Province and two to Nandi and Kaimosi. *L. simonyi* was present at Nyeri in September in sufficient numbers to be considered a potential danger, but this did not develop during the year. Severe *Antestia* attacks were observed in all the districts visited.

Three lectures to Planters' Associations were given, one at Kiambu, one at Kitale and the other at Nyeri. An exhibit, illustrating the *Antestia* work was staged as part of the entomological exhibit at the Nairobi Show, in December. A number of planters called at the Kasarini Field Station for advice and discussion of practical problems connected with coffee insects.

Asterolecanium coffeæ, Newst.

The following paragraphs are extracts from an article entitled "The Biology and Control of *Asterolecanium coffeæ* in Kenya", published in the *Bulletin of Entomological Research*, Vol. XXIV., p. 421, Sept, 1933, by Dr. James.

"Heavy infestations of *A. coffeæ* not only destroy the crop of the current season but so warp and distort the crop-bearing wood as seriously to lower the future reproductive powers of the trees. In fact there is no known scale pest of coffee in the Colony which produced such deleterious after-effects. Although in the case of bad attacks the crevices of the older bark contain a mass of scales in all stages of development, which must have a very devitalising effect on the host. it is on the young wood of the primaries and secondaries where damage of the most serious kind is inflicted. On a green twig the favourite posiiton of A. *coffeæ* is at the node, near the base of the leaf petiole, from which it can tap conveniently the conducting tissues leading to and from the leaf. Leaves which are thus deprived of their sap speedily turn black and remain on the trees, drooping in a characteristic fashion.

The green stems become sharply warped at the points where the scales are feeding and it is noticeable that the 'twist' is always towards the side where the pest is situated. The internodes beyond the points of attack are elongated and the production of long whip-like branches is a characteristic after effect. Although occasionally found on the berries, and more rarely on the leaves, they have no special partiality for these positions, and their presence in such situations is usually indicative of a bad attack.

Infestations are usually most severe and apparent towards the close of each of the two dry periods of the year, which, in the areas most affected, normally occur during the months of March and October. Although each rainy season brings about some reduction in the numbers of the pest, infestations on neglected plantations become progressively worse during each succeeding dry season.

A heavy flow of sap induced by the "rains" results in great reproductive activity among the surviving scales, and there is a noticeable migration of larvae from the older parts of tree to the rapidly developing shoots.

A. coffeae is not a honeydew producing Coccid and is therefore not attractive to ants, which play no part in the intensification of outbreaks.

A. coffeae does not possess a wide range of food plants and the writer has collected it only from Loquats and *Jacaranda* sp., in addition to coffee.

Although *A. coffeae* develops comparatively slowly and has a lower reproductive capacity than most of the common coffee *Coccidae* of Kenya, the eradication of an infestation is a matter of the utmost difficulty ,because the scales are not only embedded in small depressions formed in the green wood but are also protected by horny (*Ceravitreous*) 'tests' which resist the disintegrating action of 5 per cent caustic potash at 15° C. for twenty-four hours.

Pruning of the most drastic character will not remedy the severe distortion of the crop-bearing wood, especially when this is accompanied by the debilitating effect of masses of scales on the old wood.

Only one course of action is really economical in the case of heavily infested plantations, and that involves the cutting back of the trees to about one foot above ground level.

This operation is also know as 'stumping' and should always be performed just before the trees are about to make new growth; but as a considerable number of trees in a badly infested area will be in a state of 'dieback', stumping them in that condition may have to be accepted as the lesser of two evils.

The infested trees should be removed from the stumped area as soon as possible to avoid extensive reinfestation of the stumps and the latter should be scrubbed (not sprayed) with Orthol K and then heavily whitewashed. Afterwards inspections of the new growth should be made at frequent intervals to ensure the early detection of re-infestation.

The expense and loss resulting from stumping makes it imperative that the control measures for *A. coffeae* should be largely of a preventive nature.

The hotter and drier districts between 4,000 and 5,000 feet are peculiarly favourable for the pest, and in such localities a close supervision of the trees must be maintained and incipient outbreaks treated at once.

For light foliage infestations judicious pruning may be of value, and the infested twigs should be collected and burnt, but where the scales are present on the main stems spraying should always be resorted to. The spray recommended is Orthol K, which should be used at a strength not greater than 1 : 25 (in water) and not less than 1 in 33, and the application should be renewed not less than a fortnight and not more than six weeks after the initial one.

The second application of spray is always necessary to destroy the progeny from a number of eggs which always remain viable after the first application, owing to the protection they receive from their chorions and the 'tests' of the other scales.

The best time for spraying is near the end of each rainy season, because great reproductive activity is then occurring among the scales on the older bark of the trees and an abnormally large number of individuals are in the vulnerable mobile stage.

In cases when an infestation has been sufficiently heavy to necessitate severe pruning after spraying, due regard should be had to the condition of the trees in respect of 'dieback', and pruning would sometimes be better postponed until later in the dry season when the sap is not moving so rapidly and the trees have recovered to some extent.

The fact that parasites and predators are rarely dominant controlling factors, and that Orthol K is more effective than sprays which were formerly used, enables greater freedom to be exercised in the selection of the time for spraying. Nevertheless in choosing a time for this operation it is well to keep in mind the fact that the incidence of parasitism is always highest towards the end of the dry season and that the pest is in its most vulnerable stage at the end of the rainy season.

Most observations have led to the conclusion that the physiological condition of the host which favours the presence of this pest occurs most frequently on soils lacking in humus, and consequently the reserve of organic matter in the soil should be built up by every available means."

MR. NOTLEY'S REPORT.

Various lines of reseach have been prosecuted.

Attempts have been made to evaluate biologically the toxicity of pyrethrum extracts. The apparatus in use was found to be mechanically unsound and improved until reasonably efficient. Difficulties however were encountered in the breeding of a suitable test insect. Bean weevils were first used, but showed large individual differences in their resistance to pyrethrum. Drosophilid flies were then used, and after the difficulties of breeding them in large numbers had been overcome by the use of an artificial medium, again after promising preliminary trials showed that they were not sufficiently reliable to give significant results. At present cockroaches are being bred from a single pair, and biological testing will again be attempted when they have bred in sufficient numbers. The evaluation of the toxic principle of pyrethrum is important since it is hoped that the high toxic value of the Kenya grown pyrethrum may be maintained and perhaps improved and whilst chemical analysis will give figures for the pyrethrin content, which is the active principle, the biological test is also necessary on account of the different relative toxicities of Pyrethrin 1 and 2.

Allied with this an investigation into the cytological effect of pyrethrum was commenced, with a view to the explanation of various anomalous results obtained by the use of pyrethrum as an insecticide in various forms. This investigation is still proceeding.

A study of the taxonomy of the mealy-bugs of coffee in Kenya was also undertaken. As a result of this a new species of mealy-bug was discovered from material sent to Nairobi from Kitale. This mealy-bug still awaits description or identification; it would not appear to be a serious pest.

In conjunction with the *Antestia* research going on at Kasarini, breeding experiments were undertaken with the two varieties of *Antestia*, *faceta* and *lineaticollis*. A third variety is recorded from the Sotik district, as yet not identified. It is hoped to continue this work on return from leave.

The following are recorded as parasites of *Metadrepana andersoni*, Tams., from Sotik :—

Tachinidae *Sturmia inconspicua* Mg. *Tricholyga sorbillans* Wied. Ichneumonidae *Hemipimpla pulcher* Morley. *Xanthopimpla maculosa* Tosq., Ichneumon sp.? Braconidae *Aspilota* sp.? Chalcididae *Brachymeria bottegi* Masi., Eulophidae *Euplectrus* sp.? *Asympiesella* sp. n., *Pleurotropis* sp. n., *Tetrastichus* sp.? Predators are: Pentatomidae *Glypsus vigil* Germ. and a *Vadimon* sp.

The following Capsidae are recorded from coffee in Sotik :—

Volumnus obscurus Popp. *Deraeocoris ostentans* St. *Lygus vosseleri* Popp (?) *Lygus simonyi* Reut. and a *Lygus* and *Phytocoris* sp. not in the British Museum. *Volumnus obscurus* has also been recorded from Kericho and Kaimosi.

Phloeobius pustulosus Gerst. caused some damage to coffee on one farm in Subukia; there being no record of this Anthribiid since an outbreak in Maragua in 1929; *Phloeobius crenellatus* was also recorded for the first time in the country from coffee at Voi.

An experiment on the correlation of weevil damage to maize with moisture content has been commenced in collaboration with the Senior Agricultural Chemist.

A bulletin on the control of *Antestia* with a paraffin-pyrethrum-soap emulsion spray was published at the beginning of the year, and a leaflet on the control of *Dasus* (Gonocephalum) *simplex* is in the press. A start has been made on small scale distribution maps of the more important coffee pests for use in a proposed series of illustrated leaflets on the main pests of the Colony.

A series of lectures on agricultural entomology was given to a class from the Prince of Wales School; a few talks on insects have also been given to the native apprentices at the Scott Laboratories.

THOS. J. ANDERSON,
Senior Entomologist.

BOTANICAL SECTION

ANNUAL REPORT OF THE SENIOR MYCOLOGIST

STAFF.

I was absent on leave from the 12th July until the end of the year. Mr. Edwards, the Agricultural Officer in charge of Grassland Improvement, was absent from 11th February till 29th October.

Mr. Thorold, Mycologist, continued to be stationed at Njoro, where he was chiefly engaged on cereal disease investigations in co-operation with the staff of the Plant Breeding Station. During my absence on leave he assumed the duties of Acting Senior Mycologist. The other members of the Section had their headquarters at the Scott Agricultural Laboratories, Nairobi.

CONFERENCES, LECTURES, SHOWS AND FARMERS' DAYS.

Mr. Thorold staged mycological and botanical exhibits at the Farmers' Days held at Nakuru in March and at the Agricultural Show at Nairobi in December. He lectured on cereal diseases at the former. In addition, he addressed a meeting of pyrethrum growers held at Nakuru in November, on pyrethrum wilt disease.

Mr. Edwards attended the Agricultural Show in December and exhibited specimens illustrating his pasture work.

INVESTIGATIONAL WORK.

Mr. Edwards' work on pasture problems is the subject of a separate report submitted by him. My own opportunities for scientific investigation in 1933 were necessarily curtailed by the demands of routine administrative and advisory work, by extra duties involved in maintaining a considerable part of Mr. Edwards' activities on his departure on leave and, in the second half of the year, by my own absence on leave.

COFFEE.

Field work on coffee berry disease has been in full swing throughout the year on the special experimental station acquired on an estate in Sotik. This work has been under the local direction of Mr. H. Wilkinson, seconded from the Entomological Section for the purpose, who has had the assistance of Mr. Cottington, Plant Inspector. The programme of experimental work for the year was drawn up by a Committee consisting of the Deputy Director (Plant Industry), the Senior Agricultural Chemist, the Senior Coffee Officer and myself and consisted mainly of items under the following heads :—

(*a*) Spraying experiments.

(*b*) Bio-chemical investigations.

(*c*) Cultural methods.

(*d*) Disease resistance studies, including methods of vegetative propagation.

The report on the field work to date is being published separately as a bulletin and to avoid duplication is omitted from this report. The general trend of the observations recorded tends to support the opinion which I advanced in last year's report, that building up plantations of resistant bushes may prove to be the only final solution of the problem in those areas where conditions strongly favour the parasite.

At the laboratories at Nairobi tests were continued of the toxicity to spores of the coffee berry disease fungus of rain water samples collected from sprayed and unsprayed trees. The results obtained varied in an entirely mystifying manner. Sometimes the rain-water from a sprayed tree proved much more toxic to the spores than that from an unsprayed control, at other times there was little difference in effectiveness between the samples. No satisfactory explanation of failures on grounds of age of spray, amount of rainfall or other factors has yet presented itself.

Following representations as to the seriousness of a special form of dieback occurring on a few farms on the slopes of Mt. Elgon, Mr. Thorold spent some time during the year on field and laboratory investigations into the cause of the trouble, which has now come to be known as "Elgon dieback". As a result, he has been able to satisfy himself that the disease is non-parasitic in nature and is closely connected with lack of shade, associated with certain conditions of exposure and aspect. The way has thus been prepared for further experiments of a confirmatory nature which will also aim at the discovery of adequate control measures.

WHEAT.

Tests of stem rust (*Puccinia graminis*) samples from different districts were made as usual whenever possible, in a search for any new physiologic form which might be present in the country. None was found but the following records of the distribution of the four forms already known were obtained at various times of the year :—

K1	Rongai	October.
	Njoro	,,
	Burnt Forest	,,
K2	Rongai	September.
	Njoro	August.
	,,	October.
	,,	November.
	Mau Summit	,,
K3	Njoro	August.
	,,	October.
K4	Nairobi	September.
	Nairobi	October.
	Rongai	,,
	Njoro	August.
	,,	September.
	,,	October.
	,,	December.
	Burnt Forest	October.
	,, ,,	November.
	Ainabkoi	,,

Two Australian varieties of wheat (designated "Australian Long" and "Australian Short") were tested for resistance to stem rust and were found to be resistant to one form only (K2) of the four existing in Kenya. On the other hand, twenty-one hybrids, bred by the Plant Breeding Section, proved to be resistant to all four forms.

In addition, an attempt was made to discover which physiologic form of stem rust was present on eleven varieties of wheat received from the Belgian Congo and on one from Tanganyika Territory. The rust in all cases, however, proved unfortunately to be no longer viable.

All the above tests were carried out with care and efficiency by Mr. F. W. Evans.

Early in the year, prolonged attempts were made to obtain germination of the teleutospores of wheat stem rust collected locally. The methods used by investigators elsewhere, consisting of alternate freezing and thawing, and drying and wetting, were quite unsuccessful in the present instance and thus tended to support the opinion that, since germinable teleutospores are a necessary condition for the transfer of wheat stem rust infection to barberry, the latter is not an alternative host of the former in Kenya.

Mr. Thorold reports as follows on a very successful attempt at producing a stem rust epidemic with all four physiologic forms and also on his investigations in connection with certain other cereal diseases :—

"*Stem rust.*—A considerable amount of time and attention, especially in the earlier months of the year, was devoted to the production of an artificial stem rust epidemic, with the object of providing information for the Plant Breeder, on the resistance of hybrids and introduced varieties to stem rust. The success which was obtained in the 1933 epidemic at the Plant Breeding Station, Njoro, has certainly justified the time spent on this aspect of my work, whilst the experience gained in the course of producing rust epidemics in previous years contributed largely to the success attained in 1933. It was mentioned in my report for 1932 that it appeared as if particular seasonal conditions would be necessary for successful spread of certain forms such as K2. The year 1933 may have been particularly favourable for certain rust forms, but this is unlikely, since the early season was abnormally dry. All the four physiologic forms of stem rust were, however, produced in an epidemic form. This was of great value to the Plant Breeder in selecting varieties and single plants possessing resistance to stem rust. It is usual for only one or two forms of stem rust to occur naturally in any one year, and although the presence of the four forms leads to some difficulties in interpretation in cases of susceptibility, nevertheless the advantage of being able to select plants for resistance to all forms in one year should outweigh other such considerations.

As in previous years, continuous records of temperature and humidity during the wheat growing season have been obtained at Njoro, but it has not been possible yet to connect particular conditions with the occurrence or spread of particular forms. The extent to which all the forms occurred, when precautions were taken to aid their development and spread in the artificial epidemic, inclines one to believe that the particular conditions favourable for any one form must be looked for in factors additional to climatic ones. It should be mentioned that the year 1933, although low in rainfall in the early months, may have favoured the rust owing to temperatures and sunlight periods being greater than usual.

It has been suspected that one factor influencing the abundance and spread of different rust forms may be the length of time that the rust persists in the uredospore stage before changing to teleuto-sori. A few observations were made on three wheat varieties which are susceptible to one form only, thereby making it possible to be certain that the observations were being made on uredo- and teleuto-sori of a particular form. Notes were made on the dates of first appearance of uredo-sori on stems, and on the first appearance of teleuto-sori, in these three varieties planted at fortnightly intervals. Although there was a certain amount of variation in the periods, nevertheless K3 and possibly K4 appear to persist longer in the uredo-stage than does K2. More observations will be needed on this subject before any great reliance can be put on these results. One might expect that a rust form which persists longer in the uredo-stage would be more common and damaging than a form with a shorter period of uredospore production.

Yellow rust (Puccinia glumarum).—There is no information available yet as to whether more than one physiologic form of this rust occurs in Kenya. Knowledge on this point is of considerable importance in connection with wheat breeding work, since in the same way as with stem rust, a wheat resistant to one form may nevertheless suffer considerable damage through being susceptible to another physiologic form. The writer has been in correspondence with Professor Gassner of Brunswick, Germany, who has made an intensive study of physiologic forms of yellow rust, and through his kindness and generosity, seed of the eleven wheat varieties that are used in Germany to differentiate the forms of yellow rust, have been supplied to the writer. These varieties are now being grown in several places in this Colony, and it is hoped that by observing the rust reactions in the field it will be possible to determine whether more than one form occurs in different years or localities. So far, quite definite readings for resistance or susceptibility have been obtained from yellow rust sori on leaves, but it may be that when employed for observations in the field, the resistance or susceptibility of the varieties in the ear stage, will be a better criterion. Unfortunately the varieties are ill suited for such observations since they include winter and spring wheats, and there will be wide differences in the times of reaching maturity.

Yellow rust has been quite severe this year, and Equator wheat at Molo was more affected than usual. The results of investigations outlined above, should show whether this was an unusual physiologic form, or merely that seasonal conditions were particularly favourable for yellow rust.

Take-All (Ophiobolus graminis).—Although several farms in the Molo and Mau Summit districts still showed fields severely affected by this disease, in most cases the worst have been fallowed or planted with oats, and improvement has been reported as the result of a year's change from wheat. Definite cases of take-all were noted in experimental wheat plots and in the wheat breeding cage at the Plant Breeding Station, Njoro, during the 1933 season.

The site chosen for a rotation experiment at Molo was this year found to be less uniformly infected with take-all than was anticipated. Consequently the experimental rotations cannot be commenced until certain plots are known to be thoroughly infected.

It was therefore considered that, if a large take-all patch could be found anywhere conveniently near, it would be a great advantage to utilize it for certain experiments on take-all disease which urgently require to be carried out. An excellent site for such experiments was found on a farm (Messrs. Sayer Bros.) about four miles off the East Molo Road leading to the plots. Mr. C. A. Thornton has most kindly allowed us to use an area on the edge of some old wheat land and has provided other facilities. The plots will be within a large patch where the wheat was uniformly and badly attacked by the take-all fungus. It is proposed that various grasses should be grown in plots in this area, with the object of determining whether certain introduced grasses can be grown on old wheat land without carrying the disease through the pasture period. In addition several indigenous grasses will be planted with a similar object, but also in the hope of finding which species do harbour the disease. This experiment should provide most interesting and valuable information on the ecology of take-all disease.

Glume rot.—In the case of certain ears, a discoloration of the glumes and base of the grain was noticed, which seemed to agree with the symptoms of the 'basal glume rot' disease, known in North America, and other countries.

Bacteria were very abundant in the discoloured tissues, but none of the colonies isolated and studied agreed completely with the description of the organism (*B. atrofaciens*) which is the cause of the disease elsewhere."

MAIZE.

The following extract is taken from Mr. Thorold's report on his maize investigations :—

"Investigations have been continued on the diseases associated with fungi of the genus *Fusarium*. The writer has been in correspondence with Dr. Benjamin Koehler of Illinois, on the subject of these diseases and their occurrence in the United States. This has been most valuable in allowing a comparison of opinions on various points, and it is rather remarkable that these maize diseases should be comparable in so many respects in East Africa and the United States of America. In consequence many of the results of investigational work carried out there are applicable here also. The writer is very grateful to Dr. Koehler for supplying cultures of *Fusarium* fungi, which are most valuable for laboratory and comparative studies here.''

During the year Mr. Thorold succeeded in finding what is undoubtedly the second (*Gibberella*) stage of *Fusarium moniliforme*, one of the important causes of various maize rotting diseases. It is important to have found this second stage as its presence on old maize stalks has a bearing on the ability of the fungus to carry over from one season to the next. The newly discovered stage agreed microscopically with the description of *Gibberella moniliformis* (Sheld.) Wineland and spores from this form grown in culture gave rise to the alternate stage, *Fusarium moniliforme*. The fact that the microspores in these cultures appeared to be produced in heads, not chains, seems to place the fungus cultured in the variety *F. moniliforme* var. *subglutinans*.

The following further extracts from Mr. Thorold's report are of interest :—

''Experiments have been carried out in the laboratory for some time to find a method of treating maize seed, so as to provide seedlings free from any fungus infection. Maize seed is frequently internally infected without showing much sign of the presence of internal fungi. It had previously been found that seed treated at a temperature of 65°C. (64°-66°C. range) for ten minutes, gave a high percentage of disease-free seedlings, and germination was apparently not affected. This year heat-treated seed was planted in the field, but there the percentage of germination was seriously reduced, and the treated seed gave a stand which varied between 0-70 per cent of the untreated controls, taken as 100 per cent. This heat treatment of seed maize obviously requires some further study and experimentation before it can be utilized for experimental work.

Vernalization.—On account of the prominence given recently to Lyssenko's method for shortening the growing period of crops by pre-treatment of seed or 'vernalization', experiments were carried out on both white and yellow maize at Njoro, employing the procedure as described in Bulletin 9 of the Imperial Bureau of Plant Genetics (1933). It was found that the grains of yellow maize were easier to treat, and different amounts of moisture are probably needed in the treatment of white maize. The grains were sprouted, and maintained carefully at the required temperature in an incubator. Molds developed and caused a certain amount of trouble, and only about a 50 per cent stand was obtained after planting the treated seed. No differences could be detected as regards time of maturity between the treated and control plants, in the cases of either the yellow or the white maize.

The vernalization of wheat is carried out at low temperatures and requires some means of refrigeration. The vernalization treatment of several winter wheat varieties was carried out for me by Mr. Evans at the Scott Agricultural Laboratories and the treated seed is now being grown for comparison with untreated seed as control. It would be of great practical value if the growing period of winter wheats could be shortened in this country, as several varieties of very long growing period are used as differentials in leaf rust and yellow rust investigations."

POTATOES.

Attempts were made in 1933 to compare the merits of "seed" of certain potato varieties derived from different sources. In one case the seed had been multiplied in isolation by Mr. A. W. Hemphill at Mau Summit from original virus-free stocks obtained from Cambridge in 1931. The other seed to be compared with this consisted of ordinary local commercial seed of the same varieties.

Plots were planted at the Scott Agricultural Laboratories, Nairobi, and at the Plant Breeding Station, Njoro. The former were unfortunately a complete failure due to drought.

At Njoro, three replications of rows 50 yards long were planted as follows:—

Ordinary seed—

A.—Great Scot.

B.—Kerr's Pink.

From original virus-free stocks—

C.—Kerr's Pink Innishowen.

D.—Great Scot.

E.—Kerr's Pink Gardiner.

There were significant differences in yield equivalent to nearly one ton per acre in favour of the "virus-free" seed in the cases both of D compared with A and C compared with B. A smaller difference between the yields of B and E was not significant. This experiment does not permit drawing the conclusion that the higher yields were due to freedom from virus as there may have been a considerable effect due to differences in altitude of the localities from which the seed lots were obtained. It is hoped to repeat the experiment in 1934 with seed from more strictly comparable localities.

LINSEED.

In view of the appearance of linseed rust, *Melampsora lini* (Lk.) Desm., newly recorded in Kenya in 1932, it was considered advisable to obtain rust resistant varieties for trial. Through the courtesy of Mr. A. C. Arny of the University of Minnesota Agricultural Experiment Station, the following were obtained :—

Bison, C.I. 389,
Redwing, C.I. 320,
Rio, C.I. 280, and
Ottawa 770 B, C.I. 355.

In Minnesota, the first two are highly resistant to linseed rust while the last two are considered immune from it. All are also satisfactorily resistant to wilt disease (*Fusarium lini* Bolley).

The above four varieties were grown, amongst other places, at Kapsabet, where the rust had been severe the year before, and locally-grown Bombay linseed was included as a control. The trial, however, was a failure owing to the non-appearance of rust on any of the varieties. It is to be repeated in 1934.

GROUNDNUT.

In connection with the destructive wilt disease of groundnuts which exists at the Coast, seed of the variety "Alabama Runner" was obtained through the kindness of Mr. G. H. Miller of the University of Georgia, for a resistance trial, since this variety had been reported to be "fairly resistant" to a *Fusarium* wilt disease occurring in that State. Plants from this imported seed proved, however, to be quite susceptible to the Kenya wilt.

GENERAL.

Sugar Cane.

The reappearance of mosaic disease in a few small patches in Nyanza Province after a lapse of years was recorded in my last annual report. In spite of prompt action in having not only infected "Kampala" cane but all plantings of that variety eradicated, the disease appeared in new fields during the year. These comprised about eighty acres of Ba 11403 and Ba 11569 and some BH 10/12, all growing at Chemelil. At the end of the year the question of the desirability of continuing to try for complete elimination of mosaic disease in Nyanza Province was under consideration.

The reason for ordering the eradication of all "Kampala" cane was that introductions of this variety from native reserves had been blamed in certain quarters for the reappearance of mosaic disease in Kisumu-Londiani district and, as the total quantity involved was only a matter of an acre or two, it was considered that the gain to be derived from the destruction of all such cane without waiting for definite evidence of infection would outweigh the small hardship inflicted on the owners concerned. Most of this newly re-introduced "Kampala" cane was said to have been derived from the Maragoli area of the Kavirondo Reserve. It is, therefore, of interest to note that, during an inspection of several native "shambas" in Maragoli, carried out in the latter part of the year jointly by Messrs. Watt and Thorold, both of whom are familiar with the symptoms of the disease, no trace of mosaic was discovered. This strengthens my view, based on my own extensive, but unsuccessful, past efforts to find mosaic disease in other parts of the Kavirondo Reserve, that the original source of infection was not in the Reserve.

Extension of the areas under immune or highly resistant varieties (mainly of the P.O.J. series) progressed considerably during the year, in spite of highly adverse conditions due to drought. This second line of defence against mosaic disease is now well-established, the acreage under these varieties being sufficient to provide planting material for the whole of the non-native sugar area of the mosaic-infected districts, in the entirely hypothetical event of such a change being necessary. Multiplication of a number of Co varieties in nurseries has also advanced considerably.

Early in 1933 I obtained through the courtesy of the Government Sugarcane Expert, Coimbatore, a few cuttings of each of four (Co 351, 352, 355 and 399) of the sugarcane-sorghum hybrids produced during the last few years at that station. Amongst the benefits claimed for these plants is ability to mature in six months, while at the same time yielding a fair quantity of sugar. There seemed a possibility, therefore, that they might be of value in areas subject to periodic droughts.

The cuttings were planted at the Scott Agricultural Laboratories and good germination was obtained with each of the first three. Co 399 did not survive the journey. It is unfortunate, however, that from the time of planting onwards, the hybrids were faced with almost a record drought and were dependent to a large extent on hand-watering. Under these conditions they made very poor growth and at the end of the year had reached a height of only two to five feet. Whether they will prove more than a scientific curiosity remains to be seen. It is hoped, as soon as sufficient growth has been made to permit cutting, to arrange to have further trials made under more favourable conditions in another district.

STRIGA WEED.

A campaign to enforce the eradication of striga weed (*Striga hermonthica* Benth.) in the affected areas of Kisumu-Londiani district was again organized, although on somewhat different lines from those of previous seasons. Owing to the increasing difficulty experienced in obtaining Honorary Striga Inspectors willing to do active inspection work, and in view of the fact that experience had enabled the areas requiring extensive inspection to be narrowed down considerably, it was decided to try a system under which the Plant Inspector stationed at Songhor (Mr. C. D. Knight) would be personally responsible for all inspections of non-native farms. To assist him with inspections of squatter shambas, six native striga scouts were employed to work in different areas. Each scout was under the supervision of an Honorary Striga Inspector, who arranged his scout's itinerary but did no actual inspections himself.

The campaign successfully achieved its purpose of ensuring active measures against striga weed. Mr. Knight reported that, doubtless, in part at least, due to the lessons of previous campaigns, nearly all concerned made consistent efforts to destroy the parasite before it could set seed. Only one prosecution was instituted during the season, a conviction being obtained.

In spite of vigorous eradication during the past few seasons, striga was exceptionally prevalent in several localities in 1933. It is hoped that this merely indicates that climatic conditions in the interval between the seasons had favoured the maturation of large quantities of seed which had lain dormant in the soil for some years. If this be the true explanation, the unusually large quantities of striga plants which appeared may prove to have been a blessing in disguise, affording an exceptional opportunity of clearing land of the pest.

Mr. Knight states that the employment of the native scouts was not very successful owing to their being too prone to report a whole shamba as badly infested where a large quantity of striga weed occurred in one part only. This entailed much unnecessary travelling on the part of the Plant Inspector to assure himself of the truth or otherwise of such reports.

Herbarium.

A number of collections made mainly by Messrs. V. A. Beckley, D. C. Edwards, A. C. Maher and M. D. Graham were forwarded to the Royal Botanic Gardens, Kew, for naming. Lists of names of more than three hundred plants thus submitted were received from Kew during the year. The identifications included those of a number of essential oil plants, legumes and pasture plants of possible potential value to the Colony.

Visits to Institutions in Great Britain.

While on home leave, I visited the following institutions, to the directors and staffs of which I desire to express my thanks for courtesy and assistance received :—The Welsh Plant Breeding Station (Pasture Plants), Aberystwyth; East Malling Fruit Research Station, East Malling, Kent; Long Ashton Fruit Research Station, Bristol; The Herbarium, Royal Botanic Gardens, Kew; The Herbarium, British Museum (Natural History), South Kensington; The Imperial Mycological Institute, Kew.

I spent some days at the last-named reading in the library and examining material in one of the special laboratories maintained for the use of visitors. The latter provide a specially appreciated service.

NEW PLANT DISEASE RECORDS.

Few new diseases of importance fall to be recorded. The following have not been officially noted before although doubtless the rust on oats has been in the country for a number of years :—

Orange. In roots.—*Coniosporium geophilum* Sacc. and Trotter (provisional).

Oat. Crown rust.—*Puccinia coronata* Corda.

Rye. Leaf rust.—*Puccinia dispersa* Erikss.

Cocksfoot grass (*Dactylis glomerata*, introduced). On stems and leaves.—*Puccinia graminis* Pers.

The following are miscellaneous non-parasitic or doubtfully parasitic fungi not previously recorded in Kenya :—

On dead plant material in a maize field :—

Trichoderma lignorum (Tode) Harz.

On dead wood :—

Ganoderma applanatum (Pers.) Pat. var. *tornatum* (Pers.) Humphr.

Lenzites Palisota Fr. (*L. repanda* Fr.).

Panus conchatus Fr.

Arcyria denudata (L.) Wettst.

Fuligo cinerea Morg. var. *ecorticata* Lister.

Hemitrichia clavata Rost.

Laschia Thwaitesia Berk. et Br.

Stereum affine Lev.

Growing in forest soil :—

Geaster saccatus Fr.

ACKNOWLEDGMENTS.

In conclusion it remains to acknowledge the valuable assistance received from the directors and staffs of the Royal Botanic Gardens, Kew, and the Imperial Mycological Institute, Kew, and to thank all those whose names have been mentioned in the course of this report, for help rendered in various ways.

J. McDONALD,
Senior Mycologist.

REPORT OF THE AGRICULTURAL OFFICER IN CHARGE OF GRASSLAND IMPROVEMENT.

With the exception of the months of January, November and December, I was on leave in England. During my absence it was possible to arrange little more than the supervision of routine work.

AIMS OF THE WORK IN PROGRESS.

The scope of the work and the lines on which development is being attempted are determined primarily by the climatic conditions of different parts of the country and in the second place by the type of agricultural development, whether European or native.

Under comparatively high moisture conditions the scope for development is obviously much greater than in areas of low and erratic rainfall. The high moisture conditions are associated for the most part with the higher altitudes. In these parts of the country, although not entirely within the higher moisture areas, practically all the European stock farming is situated.

In these areas of European settlement rapid and considerable improvement of stock has been accomplished by the importation of high yielding animals and the grading up of native stock. This has resulted in a position of considerable difficulty, as the development of the live stock has gone far in advance of the development of the food supply, except in so far as expensive imported foodstuffs can be utilized.

Even in areas of comparatively high moisture conditions there is in general a period of three or four months in the year when growth of the herbage is dormant. Provision for this period even under European farming has, in the past, been very inadequate, while under native farming conditions little or no provision is made. It is probable that this annual period of starvation has far-reaching effects upon the quality of the stock, particularly as it affects the development of young animals. In parts of the country where the rainfall is low the matter of provision for this dormant period of the year is of primary importance. The growing of fodder crops for feeding green and the conservation of fodder as hay and silage is therefore a line of development on which effort is being concentrated.

As regards pasture improvement proper, there are three distinctly different problems to be dealt with associated with zones of different climatic conditions.

The comparatively high moisture areas with a rainfall ranging roughly from 40 to 60 inches per annum can be divided into two groups, the one (*a*) at altitudes of 6,000 to 6,500 feet and above and therefore experiencing lower temperature conditions and the other (*b*) below this altitude but still having good and well distributed rainfall. According to the information obtained to date, the former type of country consists mainly of potential Kikuyu grass (*Pennisetum clandestinum*) country. A considerable portion of these regions is at present covered by forest. Where the forest has been cleared recently Kikuyu grass is the dominant type in the herbage but where the land has been cleared for comparatively long periods, stages in the plant succession represented by a number of coarse grass types are often in existence. Over all these regions it appears that Kikuyu grass and indigenous clover (*Trifolium Johnstonii*) pastures can be developed fairly easily by the right management. In the whole of this zone then, the problem in hand is the development and maintenance of this type of pasture. There is little doubt that, given suitable conditions of management resulting in the right standard of soil fertility, the Kikuyu grass pastures produced will be well suited to the requirements of dairy farming which is growing in the areas under consideration.

The second group of areas presents an entirely different problem. Here Kikuyu grass is not successful and the existing type of herbage is often not suited to intensive grazing. Efforts are being made to find suitable species of grasses and legumes for the establishment of artificial pastures. A considerable number of indigenous plants is under experiment with this object in view but the difficulty of obtaining sufficient seed of these, particularly as many of them are poor seeders, makes the establishment of large scale experiments a slow process. Introduced plants are also being tested and amongst these a few have given promise. The use of European herbage species is at best limited to small areas at high altitudes, and trials are being conducted in one of these areas with a view to the use of some of these species as short leys in rotation with wheat.

For the purpose of sowing down pastures the grasses which have so far shown the most promise are :—*Cynodon plectostachyum* var. (coarse variety), *Chloris gayana* (Australian strain), *Chloris gayana* (indigenous), *Cynodon plectostachyum*, *Panicum coloratum*, *Amphilophis pertusa* and

Paspalum dilatatum. The seed of only two of the above is at present available commercially, i.e. the Australian strain of *Chloris gayana* (Rhodes grass) and *Paspalum dilatatum.* The former, which was originally introduced to Australia from Africa, has given very promising preliminary results over the past two years.

In dealing with the lower moisture areas with an annual rainfall of round about 20 inches and lower, the problems presented by European and native stock farming must be considered separately. Owing to the low moisture conditions over a large portion of the year, the possibilities of intensive management are very limited. European stock farming is in the nature of ranching while the native stock owners are more or less nomadic.

Efforts are being made to utilize drought resistant herbage plants with a view to the establishment of home paddocks which will withstand heavier grazing than the natural pastures of these areas but there is limited scope in this direction. To enable higher yielding stock to be carried, attention must be directed first and foremost to the conservation of fodder as hay and silage for use in the dry parts of the year. Development in this direction under European farming should not be a difficult matter but it is not easy to visualise so great a change in the habits of the nomadic native tribes for some considerable period to come. Until such tribes as the Masai are induced through the channels of agricultural education to turn their attention to a certain amount of arable farming for the production and storage of fodder for use in the rainless periods of the year, and *ipso facto* to change from a nomadic to a more settled way of living, it appears that attempts to improve their stock to any considerable degree will be most unlikely to meet with success.

Another important consideration in these lower moisture areas is the utilization of the natural pastures in such a way that deterioration is prevented. This can be accomplished by the application of a scheme of light rotational grazing in which the periodical rest and natural re-seeding of different areas in turn is provided for. In the case of the native stock-owning tribes this again depends on the development of a more permanent form of land tenure and a more settled way of living.

To sum up as regards the drier stock farming areas of the country, the most important line of development is that of the production and storage of fodder for the dry periods and next, control of the grazing of large areas to prevent deterioration in the herbage. Small areas of particularly drought resistant herbage plants capable of withstanding more intensive grazing may form a part of development in the future.

WORK IN PROGRESS DURING THE YEAR.

As has already been mentioned the writer was absent from the country for the greater part of the year and therefore no new experimental work was undertaken.

(*a*) The increase of material of plants in the early stages of the work was continued. This consisted of the planting out of a number of species raised in nursery beds from small amounts of material collected from various parts of the country and also of the harvesting of seed of ten one-tenth acre plots of grasses established for seed production. Seed was also harvested from a series of thirty one-fortieth acre plots used for observation and for palatability tests.

(*b*) An attempt was made to continue the system of cuts on an experimental block of 72 small plots designed to give information on seasonal yield of herbage and nutrients but, owing to the effect of constant locust attack in the early stages of the work and the partial failure of the rains in 1933, it will probably be necessary to repeat the experiment under more favourable conditions.

(*c*) Observations were made periodically on the experiments at Ngong, Kabete and Machakos centres where the effects of different intensities of grazing and of grass-burning on the natural pastures is being investigated.

(*d*) Considerable increase of a number of indigenous fodder plants was accomplished. The material is now sufficient to enable the plants to be put under comparative tests.

(*e*) Several collections of specimens were sent to the Royal Botanic Gardens, Kew, during the year, notably a fairly extensive collection of herbage species from the dry areas of the Northern Frontier Province. Identifications of a considerable amount of material sent in in 1932 were received, and in November and December a herbarium was set up.

In conclusion it may be well to give notes on the grasses and other plants which, from results to date, appear to be the most promising for the several phases of development outlined in the earlier part of this report.

Those species best suited for the sowing down of pastures have already been mentioned. A very real difficulty in this part of the work is the lack of suitable leguminous plants for inclusion in the experimental seeds mixtures. Amongst those under trial are *Trifolium Johnstonii* and *Indigofera tettensis*, both indigenous, while *Stylosanthes procumbens* introduced from Australia has given good preliminary results. Types of lucerne are also being tried in mixture with the grasses, particularly for hay production.

For hay, *Chloris gayana* (Rhodes grass) and *Cynodon plectostachyum* (Star grass) appear to be the most suitable. Both species can be readily established from seed and the Australian strain of the former, already mentioned in connection with sowing down pastures, is obtainable commercially and is probably suited to a wide range of conditions in this country.

As fodder crops there are, amongst the indigenous grasses, a number of plants under experiment for this purpose. Of these *Pennisetum purpureum* (Napier grass) is already becoming widely known by European stock farmers. This plant is decidedly drought resistant and gives an excellent yield of green fodder. In addition it has the advantage of being a perennial. It has given very good results in most of the widely different parts of the country in which trials have been made. Other grasses which have shown marked promise but which have yet to be tested more thoroughly are *Pennisetum giganteum*, a large *Echinochloa* species and *Panicum trichocladum*. Apart from these grasses the more usual fodder crops such as lucerne will play an important part in future development. This plant, however, can only be grown successfully in limited parts of the country. The areas in which it can be produced can probably be extended by the production of locally grown, acclimatised seed. This is an advance to which attention has been given recently. There is a considerable number of indigenous plants worthy of trial for fodder purposes and the number under experiment is being constantly increased.

D. C. EDWARDS,
Agricultural Officer in charge
Grassland Improvement.

CHEMICAL SECTION

REPORT OF THE SENIOR AGRICULTURAL CHEMIST

The staff of the section was brought up to its normal strength by the transference of Mr. L. Burton from the Medical Department as Junior Laboratory Assistant on 1st April, 1933.

The number of samples received during the year has increased by over two hundred. Their nature is given in the table below.

	Outstanding at 31-12-32	Received	Examined	Refused	Outstanding at 31-12-33
Dips	—	525	515	7	3
Soils	80	673	649	2	102
Manures	—	73	70	3	..
Coffee	27	22	49	—	—
Essential Oils ..	5	49	54	—	—
Insecticides.. ..	—	12	12	—	—
Feeding Stuffs ..	—	4	4	—	—
Toxicological ..	—	32	31	1	—
Wireworm Remedy	—	27	24	—	3
Miscellaneous ..	10	133	118	1	24
	122	1,550	1,526	14	132

On behalf of the Division of Animal Industry a good deal of work has been done so, as last year, this work will be discussed first.

DIVISION OF ANIMAL INDUSTRY.

DIPS.

The accuracy of the dip samples received has remained practically unchanged. There are still too many inexcusably inaccurate; perhaps, in many cases, samples are only sent in when the dip owner suspects the dip wash is badly out of adjustment or he has been obtaining bad results with his own dip tester. The results of the analyses of the samples this year compared with those of the two previous years are given below.

Extent of Error	1931		1932		1933	
	No.	Per cent	No.	Per cent	No.	Per cent
Within 1 per cent	48	8·9	29	6·0	50	9·7
Between 1 and 5 per cent ..	91	16·8	100	20·6	88	17·2
Between 5 and 10 per cent ..	102	18·9	102	21·0	90	17·5
Between 10 and 20 per cent ..	136	25·2	111	22·8	118	23·0
Over 20 per cent	163	30·2	144	29·6	167	32·6

TOXICOLOGICAL.

The number of toxicological samples received during the year has dropped to normal, a decrease of about 60 per cent of last year's number. There is certainly some relationship between the number of samples received and a locust campaign, but whether a locust compaign causes any marked increase in stock mortality is to be doubted. There is much carelessness in the disposal of arsenicals. One case worthy of record is that of a dip owner who on cleansing out his tank permitted a great deal of the dip wash to run into a river! Fortunately the river was large or there would have been a crop of human and stock deaths.

The writer is of the opinion that it is such items of utter carelessness that were responsible for stock fatalities during the last locust campaign rather than stock picking up locust poison.

FEEDING STUFFS.

Very few stock feeds have been examined during the year. The few analysed have mainly been oil cakes assayed for oil content. Many of the local oil cakes are produced in comparatively primitive presses and contain too much oil to permit of their wide use. As the number of modern hydraulic presses in the country increases so will the average quality of the cakes improve.

WIREWORM REMEDY.

Twenty-seven samples of wireworm remedy were received from the Veterinary Research Laboratory for regulatory analyses.

DIVISION OF PLANT INDUSTRY.

SOILS FOR IRRIGATION.

In connection with the improvement of the Kamasia-Njemps Reserve, the writer visited the Baringo-Hannington Basin to ascertain if there were any possibility of ameliorating conditions by irrigation. It was found that in a number of cases the Njemps were producing crops by irrigation, constructing their own weirs and canals and using a form of basin irrigation. This system has been in use by them for many years and it appears that these people would readily take up better systems of irrigation.

The water supply in this area is definitely poor, both in quantity and quality. Considering the general nature of the soil, it is wondeful that the Njecmps have succeeded in producing crops with the alkaline water in use. These conditions effectively prevent any attempt to irrigate, by means of modern works, this part of the reserve. The plains to the east of the Molo River, while good soil, are considered to offer too great difficulties to a people starting irrigation. In the Baringo basin, however, below the Perkerra River, the main tributary of the Molo, there is a large area eminently suitable for irrigation by a primitive people. The soil is such as will not easily be spoiled by over irrigation, is comparatively free from soluble salts and is well drained. The development of this area has been recommended and a scheme drawn up for the settlement of the irrigible area.

The development of the Tana River delta has been receiving a good deal of attention. A series of about one hundred soil samples, representing nineteen profiles in the river valley and delta from Kibusu to the sea and from Witu to Kipini has been under investigation.

In the Tana River valley proper the soils above the junction of the Belazoni canal are very free from salts but from here on the concentration becomes increasingly greater till near the coast there is a much as 2 per cent of soluble salt in the soil. In the Witu-Kipini zone too there is the same increase in salt content as one approaches the coast.

Although there are evidences that the fresh water in the Belazoni canal has leached out a great deal of the soluble salt, it is to be doubted if much of the true delta can be properly utilized except by using special crops. Many of the soils in this area are very peculiar. As received they appeared to be coarse sands but when wet became very sticky, and, during the shaking with water, to obtain the water extract, were converted into a thick gluey suspension, closely resembling a suspension of bentonite. The rapid clearing of the suspension on standing indicates that this colloidal material is highly flocculated by the salt content. Probably it is these soils that cause the marsh and swamp formation in the delta when the river floods.

The upper part of the valley would present no difficulty when irrigated, the soils are very free from soluble salts, while the conditions of the profiles indicate good drainage. Many of these soils, however, are coarse sands which would be very hungry under cultivation. Selection of soils suitable for cultivation must be undertaken.

NITROGEN DISTRIBUTION IN COFFEE SOIL.

The work on nitrification and nitrates in soil mentioned on page 114 of the Annual Report for 1932, has been extended to cover the distribution of nitrate nitrogen with depth in the soil under coffee and under a soil mulch. The long continued drought has prevented the proper prosecution of the work. What rain did fall during the experiment was insufficient and distributed over too short a time to carry down, into the soil, any marked quantities of nitrate nitrogen. The experiment, which involves sampling the soil to a depth of 11 feet, will be continued during 1934.

Enough information has been accumulated to show that for the proper study of the nutrition of plants, one must consider conditions in the subsoil as well as in the surface soil. Agriculturalists have been so obsessed by conditions in the surface soil that they have forgotten the function of the deeper roots and their development in the subsoil. The observations of previous workers on this subject have been overlooked. Our observations have shown that coffee takes in a very great deal of its nitrogen requirement in the form of nitrates in the subsoil, leached down from the surface soil. There are also indications that during a drought there is an upward movement of water from the depths below those reached by the coffee roots and thus a replenishment of soil nutrients, notably nitrates, in the feeding zone of the coffee.

COMPOST.

A great deal of interest has been evinced in the Indore process of making compost, published in "Waste Products of Agriculture," by Messrs. Howard and Wad. There is no doubt that the methods advocated by these authorities are a great advance on the old-fashioned method of tight pitting. The turning, advocated, does aerate the material and permit of even wetting with the production of a more uniform material.

There are certain points which have been overlooked by those practising the system locally. The Indore method has been worked out for peasant owners and the soils of Indore. On the large scale only those practising mixed farming are likely to obtain sufficient urine earth and dung to work the process. With most planters and arable farmers in the Colony stock are merely an adjunct to the main activities. The production of as many thousands of tons of manure as hundreds are produced by the peasant requires a very different organization from that described.

Again the soils of the major arable parts of Kenya are all definitely acid. The Indore soils are alkaline and carry a fair amount of available calcium carbonate. Whereas in the method described, soil is added to neutralise acids produced, in Kenya the addition of some base supplying mineral is essential.

With these points in mind, a modified process is being evolved, in which nitrogen is partly supplied as sulphate of ammonia, the base is rock phosphate or some such similar phosphate and generally only one turn is given. The results so far have been very encouraging and lead one to conclude that for large scale operations this modified method is most suitable.

As far as the native cultivators are concerned, there is little doubt that a slightly modified Indore method would be suitable. In Kenya, so far, there has been no need to use dung as fuel so all the dung can be used. For the same reason the waste materials can be spread in the bomas for crushing and impregnation with urine. The turnings, waterings, etc., should be retained since labour, in these cases, is of no value and a better product is obtained.

Coffee.

Although it would appear from the table of samples received that very little work has been done on coffee, the contrary is the case. A great many of the soil samples are connected with work on coffee while much of the work has not involved analysis.

As regards the work on the distribution of copper in and the effect of copper on the coffee plant, this has had to stand aside, partly owing to pressure of other work and partly to an inadvertent error in the experiment. The latter has led to a most interesting observation. The introduction of an excess of copper led to the death of sucker shoots from the base of the tree. All new leaves produced were very small, hard and crisp. It is hoped during the coming year to be able to return to the subject.

The observations made on coffee in the field and of coffee root systems have substantiated the writer's opinion that it is dangerous to generalise regarding the behaviour of coffee. Much has been made of the effect of soil acidity on the root system of coffee. Two groups of systems have been studied showing the same major acidity alterations, yet the root systems are very different. It is certain that here one has to consider more than the acidity factor, every factor influencing the plant in any way must be taken into consideration.

The symptom of "dieback" too is illustrative. There is a tendency to regard "dieback" as indicative of one main cause. It is possible, at present, to refer to at least three forms of "dieback". The common type on overbearing trees is associated with hollow cherries and is ameliorated by the addition of available nitrogen to the soil. In this form there is no death of roots and the tree recovers quickly. A less common form, found in a few districts only and also in young trees prematurely bearing heavily, is associated with well-filled cherries and is not alleviated by nitrogenous fertilisers. Here there is death of roots, often so severe that only one or two main roots are left, and the tree either never recovers or is a burden for many years. The third form appears to be associated with climatic conditions. Thus here we have one symptom due to several causes. Generalisation under such conditions is liable to lead one into deep waters.

ESSENTIAL OILS.

There is every sign that essential oil production will become a definite large industry in Kenya. We are beginning to see results from our spade work of the past few years. Interest in the subject is very keen and many people wish to enter into production. There is one danger if care be not taken. The oils must be of the highest quality and production must be so regulated that supply does not exceed demand. Unless due consideration be given to these points many of those growing essential oil plants will be courting disaster.

The investigation into the variation in the character of cedar wood oil, foreshadowed in last year's annual report, has been conducted. One of the points investigated was the variation in the amount of cedrol crystallising from oils. The crystalline cedrol content has been found to be closely tied up with the age of the tree. The older the tree the less is the cedrol separating from the oil. In some cases oil from young trees crystallised to a solid mass and so rapidly as to form a mottled mass of "figged" crystals. Further preliminary work indicates that the oils from old trees contains more cedrol than those separated from crystals in oils from younger trees. An authoritative statement however is not possible yet, an exact method for assaying control has to be evolved.

As regards variation in colour the position is not clear. It appears that the colour of oil is closely tied up with locality. For example, the oil from one area has always been pale yellow, yet from another twenty miles away it is always nearly black. It is difficult to see why this should be. All one can do at present is to accept the fact.

The number of strains of *Pelargonium radula* under trial during the year was eleven. Of these six had been multiplied in sufficient quantity to permit of enough oil being obtained for examination. The oil from one strain is poor, resembling the ordinary "Mawah". From the other five strains good geranium oils have been obtained, differing slightly in odour character but all very close to each other. Opinion from London is that all these oils would be readily saleable, although opinions vary somewhat in the order of odour value in which they are placed. The character of these oils is very different from Bourbon or Algerian oils. On first dip they lack the nauseating, cloying sweetness of these well known oils. Under Kenya conditions they appear to be more lasting.

It has been decided to issue in bulk cuttings of the strains that give the largest yields of oil. Working with leaf material, the yields vary from 0.06 per cent to 0.25 per cent. Obviously, since the oils are practically identical, the latter strain is the one to develop. The drought, however, has greatly retarded growth so it will not be possible to issue as many cuttings as was anticipated.

One point worthy of mention is the appearance of a fungoid disease this year, which has been identified by the Acting Senior Mycologist as *Rhizoctonia solane*. Although the fungus kills the plant affected it does not really appear to be serious. Isolated plants only are killed. Probably owing to debilitation, caused by the dry conditions, the resistance of the plants has been reduced sufficiently to enable the parasite to obtain hold.

Peppermint has now reached the field stage of cultivation and the first lot of experimentally produced oil was very favourably received in London. There is every indication that next year oil will be exported in bulk. The growth of the mint has been very fast, in one year the soil is choked with rhizomes. In this state there is a tendency for the stem growth to be poor which makes harvesting impossible. Contrary to one's expectation peppermint in Kenya will require severe cultivation if it is to be kept in proper growth. Spring tine and disc cultivators appear to be too light, ploughing of the field to expose and kill the greater part of the runners is necessary. Preliminary experiments show that slow acting nitrogenous manures have had a beneficial effect but whether their use will replace ploughing remains to be proved.

A very great variation in the quality of the oil with locality has been observed. All the peppermint under observation is the progeny of a single plant so there can be no question of strain being the deciding factor, climatic and soil conditions are responsible. The cultivation of peppermint must be confined to those areas where the conditions are suitable for the production of the best quality.

While on this subject of variation in quality of oils, a similar, though much less marked, variation has been observed in geranium oil. The Njoro oils are better than those produced at the Scott Agricultural Laboratories. The variation observed, however, is not sufficient to warrant restriction of geranium to definite districts.

Of the other oils produced experimentally, three merit mention. Muhugu oil from the wood of *Brachylaena hutchinsii* promises to become established on the market. It is a heavy oil carrying an odour reminiscent of vetivert. It appears that there will be a definite, if small, market for lemon grass oil. A wild grass, *Cymbopogon afronardus*, Stapf., growing on poor stony land, has been found to give a large yield of an oil reminiscent of palmarosa and ginger grass oils. This grass is widely distributed but only that from the higher altitudes gives the large yield of oil. It appears that there may be a market for this oil. The last is really an oleo resin extracted from the wood of a small tree, believed to be *Spirostachys africana*. This material is arousing a certain amount of interest in Great Britain and will probably give rise to a small industry.

INSECTICIDES.

Pyrethrum has become a most promising crop in Kenya for the higher altitudes. While in the neighbourhood of Nairobi about 40 per cent of the plants have remained blind and not flowered even in four years, very few blind plants are found in fields over 7,000 feet. The yield per acre too seems to progress with increasing altitude. A yield of 2 cwt. per acre would be good at 5,000 feet while at 9,000 feet a yield of 10 cwt. per acre has been recorded from a field in its first year.

Such yields coupled with the fact that flowering is almost perennial should put Kenya into the forefront as a pyrethrum producer. The ability to supply fresh flowers at any time, flowers that have deteriorated least, will tend to make the large users of pyrethrum look to Kenya for their supplies. Added to this the pyrethrin content, to the best of our knowledge, is high, about 1.5 per cent.

It was intended to make a close survey of pyrethrum with special reference to the pyrethrin content during the year. Unfortunately it has been found impossible to obtain concordant results with most of the methods which have been evolved for the assay. At the time of writing the only method which is at all reliable is one which is regarded with disfavour elsewhere. However, unless a better method of chemically assaying pyrethrum is evolved, this method will have to become our standard. In conjunction with the Entomological Section, which is working on biological assay, it may be possible to arrive at some reliable correlation.

A certain amount of interest has been shown in the growing of tobacco for nicotine. This may be profitable where pyrethrum does not do well if varieties containing a high percentage of nicotine are grown. That these are present in the Colony is shown by one sample which was found to assay 11 per cent nicotine, the variety being an imported Tunisian. Such tobacco would of course be useless for smoking, it would have to be grown for nicotine extraction only.

Besides the ordinary Tephrosias, usually grown mainly as green manures there are a number of indigenous ones which may have possibilities as insecticides. For certain purposes the toxic principles of the Tephrosias are more suitable than pyrethrum. Samples of these have been obtained and are under investigation.

MISCELLANEOUS.

Under this heading have been classed samples which appear sporadically, perhaps, in number, once or twice in connection with some special investigation. One or two of these latter merit special mention.

One of the faults that completely spoil white Madagascar butter beans for the London market is the fault of black eye. This fault appears on boiling and consists of a black discolouration around the hilum and may, in bad cases, extend over almost half the bean. The discolouration is confined to the outer seed coat only and in no way affects the food value of the bean. It was found possible to recognize in the raw beans a condition which would, on boiling, give black eye. The indication in the raw is a peculiar greeny yellow discolouration of the hilum and over the radicle. The opinion is advanced that the condition is associated with climatic conditions at the time of ripening. In order to test the suggestion that the fault is genetic an experiment has been started in conjunction with the Plant Breeder.

At the request of the Fish Warden a number of samples of water have been examined. One of the most interesting was the case of two parallel rivers in one of which trout spawned normally, while in the other spawning seldom or never occurred. The most outstanding difference between the waters was the difference in phosphate content. The water from the first river contained twice as much phosphate as that from the second, which leads one to the conclusion that the fish have been affected by the lack of phosphate.

GENERAL.

Officers of the section attended the agricultural shows at Nakuru and Nairobi, where exhibits were staged and the officers acted as judges and stewards.

The Soil Chemist gave a series of lectures on soil science to students from the Prince of Wales School.

Several planters' meetings were attended and lectures were delivered on a variety of subjects.

The Soil Chemist visited the East African Agricultural Research Station where he had many interesting and informative discussions with the staff there.

During the year two bulletins were revised and three articles published.

The thanks of the writer are due to the Imperial Institute for their continued interest in the devlopment of the essential oil industry.

SOILS AND MANURES.

Mr. Gethin-Jones' Report.

During the course of the year 337 soil samples and 71 fertilizer samples have been dealt with. An analysis of the soil work gives the following classification of laboratory work involving soil analyses: 67 soil samples were examined and reported upon for private individuals; 147 dealt with laboratory investigational work, mainly determinations of soil moisture, total nitrogen, "available" phosphates and pH values. A further 123 profile soil samples have been collected for soil survey purposes. These, together with similar samples outstanding from the previous year have been subjected to pH value determinations by the hydrogen electrode method.

There has been an increase in the number of soils examined for private individuals. The majority were brought along to the laboratories by individual farmers where simple quantitative soil nutrient examinations were carried out while the local conditions of topography, rainfall, soil-water conditions, cultural methods and crop history were discussed, and advice given accordingly. Many post enquiries often accompanied by soil samples are received for the carrying out of certain standard chargeable analyses. Though the chemical section is pleased to help, it is found that many farmers who are anxious to know more about the manurial needs of their soils do not care to pay the necessary schedule fees for these exact quantitative analyses and there the enquiry ends. The writer feels that such farmers should be encouraged to bring representative soil samples to the department's laboratories where the manurial and cultural problems can be discussed and simple tests carried out.

Soil Investigational Work.

The soil investigation work carried out includes a continuation of laboratory work on the phosphate-status of the Kikuyu red loam and a study of the natural water and total nitrogen content of this typical coffee soil under various surface coverings. Sand culture work with coffee with a view to correlating mineral deficiencies with certain characteristic physiological symptoms and laboratory work on the lime-status of the Njoro cereal soils has also been continued.

Initial work on the phosphate-status of the Kikuyu red loam mentioned on page 115 of the Annual Report for 1932 showed that the arbitrary static method of estimating and quoting the "available" phosphoric oxide was misleading as the initial amount removed is rapidly replaced by about a similar amount which passes from the "unavailable" to the "available" form. This equilibrium has now been tested with regard to added soluble phosphatic fertilizers and shows an equally rapid change over from "available" to "unavailable".

It is found that the "available" P_2O_5 is always limited and that much of the applied water-soluble phosphoric oxide becomes "adsorbed" by the soil so that it is not extracted even by a weak acid solution. Subsequent extractions would have yielded further amounts in solution, thus the added phosphate is not lost but is made available for later plant growth. This temporary locking up of this nutrient is probably enhanced in that much of any applied soluble phosphatic fertilizer is fixed soon after application in the uppermost layers of soil, thus causing a poor distribution of added phosphate throughout the region of the feeding roots. It is probable—and there is some field evidence for this—that the response to phosphatic manuring is more marked in soils that are not low in humus, hence response to phosphatic manuring of worn-out soils could be hastened by applying the fertilizer in conjunction with organic matter, e.g. a phosphate rich compost or as bone meal which is well distributed throughout the soil. This work with special reference to a comparison of soluble phosphatic fertilizers with the cheaper mineral phosphates will be continued. Also, when both kinds of phosphatic fertilizers are added to the soil in conjunction with organic matter in the form of a phosphate-rich compost.

Field work on the natural water content of a typical coffee soil mentioned on page 115 in last year's Annual Report was continued until the end of the 1933 drought in mid October, when the total rainfall for the year was 15 inches. At the beginning of the year continuous fairly heavy falls of rain, amounting to a total of 4.47 inches over ten consecutive wet days, raised the subsoil moisture content under all surface coverings by 5 per cent to 6 per cent. The subsoil under grass mulch which was initially higher showed a smaller rise than the others, but still contained rather more natural moisture. During the subsequent dry weather there was a gradual falling off in moisture content throughout all depths, that of the clean area top-soil being the most rapid and the grass mulched top-soil the least rapid. The long rains, amounting to 5.64 inches falling during the last week of April and the month of May, were about sufficient to raise the subsoil moisture content to about the January level of 25 per cent, except in the case of areas carrying permanent crops which it is assumed utilized much of the limited rainfall. The first month of the subsequent drought reduced all top-soil and subsoil moisture rapidly except in the case of the soil mulch subsoil and both top-soil and subsoil of the grass mulched areas. The continuation of the drought caused further drying at all soil depths, the subsoil of both clean and grass mulch areas containing about 2 per cent more moisture—equivalent to about 1½ inches of water in 45 inches of subsoil—than the other areas carrying short and long term green manures.

An independent examination of the subsoil pore space was made, thus enabling one to express percentage moisture by weight into acre inches of soil water. The air dry moisture content of the subsoil of 9 inches to 54 inches varies between about 25 per cent after good rains to about 18 per cent after prolonged drought. This amounts to about 40 per cent and 29 per cent respectively of the subsoil by volume, being equivalent to some 18 inches and 13 inches of water respectively contained in the 45 inches of subsoil examined. Most of this water is held tightly by the soil and is quite unavailable for plant growth: the value of about 15 per cent by weight or 24 per cent by volume would probably represent the wilting-coefficient of these red coffee subsoils which contain much reactive colloidal materials. However, there remains a wide margin between the wilting point and the amount of intersticial water that the soil can hold against gravity and thus conserve to cover dry periods. This limited zone of subsoil can thus conserve at least 5 inches of water collected during the rains which it can yield to support the coffee tree during the subsequent drought. The undisturbed subsoil was found to have a pore space of about 57 per cent and solid matter about 43 per cent, both values expressed by volume. This allows for ample aeration even when holding the higher figure of about 40 per cent by volume of conserved water. The inherent physical properties of the Kikuyu red loam show this soil to be exceptionally favourable for tree and bush growth, provided that other edaphic factors and climate are also suitable.

Growth measurements of a young coffee tree showed a vertical shoot growth of about a third of an inch per week for the first nine months, then faster growth at about two-thirds of an inch per week for some three months between bud formation and flowering. Vertical growth now dropped again to about the previous rate for the next three months, gradually slowing down as a fairly heavy initial crop ripened. The young tree suffered severely from overbearing and the die-back of the lateral branches during which period the vertical growth almost entirely ceased, being one inch only in five months. Lateral growth rapidly slowed down but did not cease until leaf fall and die-back had set in. There is some evidence from other trees that shoot growth is fairly continuous with increased growth during bud development, even when carrying a normal crop, provided that the nutrient supply is adequate for both purposes.

Sand culture work with coffee arranged to correlate mineral deficiencies with any characteristic physiological symptoms, which was initiated in 1931 has now reached the stage when certain conclusions can be drawn. As one might expect, the coffee tree receiving nutrient solution lacking in nitrogen is outstanding for its stunted growth with short internodes and small yellow leaves. The total vertical growth over two years is 7 inches as compared to an average growth of 26 inches for the ten trees in this mineral deficiency series. The habit of growth is very representative of areas of neglected coffee with rank growth of weeds and more especially couch grass. All the coffee trees grown in sand culture, excepting the one of stunted growth referred to, exhibit varying amounts of leaf scorch. In the case of the tree receiving no potash, a tentative statement may be made that it shows relatively more of this tip and marginal leaf scorch, more especially during hot weather. Although the ten trees under observation were from seeds of the same mother tree and were fairly uniform when planted out, there is now a wide variation in their habit of growth and time of bearing quite apart from the nutritional factors involved. It is outstanding that the stage in crop production has a very marked effect on the general appearance of the tree.

In conjunction with the Officer in Charge of Grassland Improvement, the grassland manurial experiments have been continued at the three Government Veterinary Centres. The effects of locusts and severe drought have obscured observational results, but it appears that boma manure and nitrogenous top-dressings gave a better and more prolonged growth of grasses, whereas phosphatic manuring encouraged clover growth in a herbage consisting mainly of *Pennisetum clandestinum* at Kabete. This work is being continued.

Manures.

During the year the following range of materials have been examined and reported upon:—21 samples of bird guano, bat guano, compost and other organic manures; 17 samples of by-product manures of animal origin; 14 samples of mineral fertilizers and 17 samples of local limestones. Continued interest has been shown in the possibilities of local coastal guanos. Samples analysed vary greatly in composition; it appears that the better quality material, containing 15 per cent to 20 per cent phosphoric oxide together with about 1 per cent nitrogen could be developed, provided that the deposits are fairly extensive. Numerous samples of cave bat guanos analysed show these to contain 4 per cent to 5 per cent nitrogen, 5 per cent to 8 per cent phosphoric oxide and about 3 per cent potash. These scattered and small deposits are worthy of development for local use, but it is likely that they could not stand the cost of drying, transport and marketing unless they occur in economic quantities in areas involving but short road transportation. The production of animal by-product manures such as bone meal, meat meal and blood meal has now become an established industry, but as yet the output is limited. This successful development in the utilization of animal carcasses should eventually assist in the urgent problem of counteracting overstocking and hence severe soil erosion in certain native reserves.

The limestone survey of the Colony is being continued; local deposits of fair quality limestone (70 per cent to 80 per cent calcium carbonate) have been recorded from Hoey's Bridge, Mount Elgon, Songhor and Ngobit. Two samples of metasomatic limestone from Baringo were found to contain about 90 per cent, and another sedimentary deposit from Kendu Bay about 95 per cent calcium carbonate. A series of crystalline samples from the Elgeyo Reserve varied in composition from 80 per cent to 95 per cent calcium carbonate with only traces of the oxides of iron and aluminium. One sample contained 60.1 per cent calcium carbonate and 33.1 per cent magnesium carbonate, thus representing a high grade dolomitic limestone. Two samples of crystalline from the Simba-Kilimanjaro area were found to be dolomitic limestones containing about 55 per cent calcium carbonate and about 30 per cent magnesium limestone. The limestone survey indicates that, with the possible exception of the Trans Nzoia, the Colony has vast reserves of fair to high grade limestone, most of which are fairly central for the railway distribution of the ground material to the adjoining districts. Many of these limestone deposits contain about 2 per cent to 3 per cent of phosphoric oxide, thus when liming becomes a farm practice appreciable amounts of phosphate will *pari passu* be added to the soil.

Soil Survey.

During the year under review a total of some four weeks has been devoted to carrying out a preliminary reconnaissance through different parts of the Colony, mainly in the native reserves. In company with the Agricultural Officer for the Central Province, a brief tour was made of portions of the Nyeri South, Embu and Meru Districts, special attention being paid to the potential coffee soils in the latter two districts. The essential feature of the South Nyeri District is the comparatively remarkable uniformity of the soil conditions throughout most of the area. It is probable that some 70 per cent of the land between altitudes of about 5,000 feet and 7,000 feet has a fairly deep to very deep fertile red loam Kikuyu loam) derived from the weathering of previous volcanic rocks. Another prominent feature is the large acreage of broad low lying papyrus and "Ithangi"-fern swamps (Kagumu loamy peat) which act as natural filters of eroded material from the adjoining ridges. When properly drained these swamps can be made to produce good yields of a variety of both subsistence and cash crops, more especially in drought years. Though these wettish peaty soils are intensely acid in reaction having normal and exchange pH values of 4.0 and 3.4 respectively as determined by the hydrogen electrode method, yet they certainly produce good crops as shown by various plantings at Kagumu and Itagwa in the reserves and when planted with sugar cane as at Mambre Estates of Sukari Limited. One thus learns that the degree of soil acidity must be given a different interpretation in the case of these peaty soils with a permanent water-table at about two feet. Growth tends to be luxurious due to the rapid decomposition and the rendering available of plant nutrients following drainage. It is therefore necessary that the initial lowering of the water-table must not be more than necessary for normal growth. This would also lessen the danger of the accidental burning of a thick layer of dry loamy peat.

In the Embu district there is much very fertile land of the Kikuyu loam type with good rainfall stretching from the upper reaches of the Regathi Valley towards Kereguye and Embu, more especially at the higher elevations. In the high rainfall areas of over some 50 inches per annum on the easterly lower slopes of Mount Kenya beyond Embu, the natural vegetal zones occur at lower elevations and the generally more fertile land for most native crops occurs at relatively lower levels. To the south of Kereguye, between the Sagana and Nyamindi Rivers there is a lower-lying belt (4,000-4,500 feet) of some 50,000 acres of gently undulating fairly good soil with a rainfall of 35 inches to 45 inches which would probably prove to be suitable for the extensive production of comparatively low altitude crops such as simsim, pigeon peas, ground nuts and more especially cotton. The greatest distance from the railway would be about twenty-five miles.

In the Meru district there is some good land (Kikuyu loam) which is already intensely cultivated. Southwards from Meru towards Igogi the country becomes markedly undulating and carries a yellowish to fawn brown very acid soil (Iveti loam) which supports a secondary vegetal covering of bracken. Northeastwards from Meru at Ithanana and Akirangondo, at about 6,000 feet under heavy rainfall, there are local level stretches of a deep light brown soil (Lari loam) with much Iveti loam carrying bracken on the steeper eastern slopes. Below the latter there occurs much fertile dark brown reassorted soil (Ura loam).

A survey of potential coffee soils in certain portions of the Embu and Meru districts showed limited areas of highly suitable land (Kikuyu loam) in the near vicinity of Embu Station and scattered areas of varied soils including some Kikuyu loam in the Meru district. Throughout these native reserves the intensity of population bears a close relation to soil fertility; the better land, more especially near the Government stations, is almost invariably already intensely cultivated though in the more outlandish regions there are certain cases of good land as yet not fully occupied.

A brief tour of parts of the Machakos district showed that over large areas the present distribution of soils was the resultant of the balance between soil erosion and soil accumulation, though most of the reassorted deposits towards the

Athi River are relics of ancient deposition while the outstanding characteristics of eroded areas are due to very recent erosion. Soil erosion is closely connected with unprotected vegetal covering brought about by overgrazing.

During the year soil surveys of the Nairobi Commonage and the proposed site for a prison farm were carried out.

Soil Classification and Nomenclature.

Two systems of soil classification are in use. The one is on an universal scale for the purpose of including this Colony in an Empire or World soil map. It is based on the broad climatic soil types such as required by the Imperial Agricultural Conference of 1927 or the International Society of Soil Science. As agreed by the Conference of East African Soil Chemists held at Amani in 1932, this classification is being proceeded with on a scale of 1 : 2,000,000 as different parts of the Colony are visited.

A second system of soil survey which is carried out with much more detail involves a scientific classification of the natural soil as it appears in profile without direct reference to its crop-carrying capacity. This method of classification is believed to be ultimately the best method that will lend itself to the application of soil science to soil utilization and agricultural practice. Such a classification is on the lines of the established American method and a similar one which is now being evolved in Britain. Up to the present some two dozen soil series bearing representative locality names have been tentatively established. Many of these soil series are widely distributed throughout the Colony where similar geological, climatic and other soil forming factors obtain. At present the occurrence and extent of the different soil series are recorded and no attempt is made to delineate them in the field. These soil series are represented by profile samples which vary in number from two to six according to the depth and zonation of the natural soil. A total of some 150 individual soil samples has been taken and their pH value determined by the hydrogen electrode method. There is fair agreement within the respective soil series. A progress report of this work with suggested locality names and series descriptions will in due course be submitted to the Agricultural Research Station, Amani, for correlation purposes. Certain of the main soil series are represented by life-size monoliths, which give a more complete picture of the natural soil profile.

V. A. BECKLEY,
Senior Agricultural Chemist.

PLANT BREEDING SERVICES

REPORT OF THE ACTING SENIOR PLANT BREEDER

STAFF.

On Mr. Burton's return from home leave on April 24th, he was appointed Acting Deputy Director (Plant Industry) and was stationed at Headquarters in Nairobi, whilst Mr. Lathbury was appointed Acting Senior Plant Breeder and remained stationed at Njoro.

Until the reappointment of Mr. Benstead on September 1st, as Agricultural Officer for the Nakuru District (Molo and Rongai areas), Mr. Spranger had to do all the district work as well as his own work on the Plant Breding Station, and the full programme of district work could not be carried out.

Mr. Lathbury took over some of the agricultural work on the station in addition to his plant breeding.

Mr. Thorold, Mycologist, remained posted at the Plant Breeding Station for the whole of the year and, during the period when there was a shortage of staff, gave invaluable help in the field on matters other than of a mycological nature.

WHEAT AND WHEAT BREEDING.

General.

The acreage seeded, as in 1932, was in the region of 40,000 acres but whereas in that year the average yield was 2.1 bags per acre, this year the average rose to 4.70. Many instances have been recorded of farmers having reaped over ten bags to the acre off some fields. Local milling requirements will therefore be satisfied, leaving a small balance available for export.

The high yields reaped in 1933 were in part due to the favourable season. The wheat grew well despite the dry conditions in some districts and damage by stem rust was small. Yellow rust infection was severe at high altitudes and responsible for some damage. Black chaff, glume blotch and scab, whilst present, were not bad. Take-all was not nearly so widespread as in 1932, largely owing to the fact that farmers have realized the importance of rotating or fallowing their wheat land periodically and have been able to put this principle into effect. In part, however, the high yields were due to the utilization of the most suitable land. In the past the practice in some lower altitude areas was to plant maize first and then to sow wheat at a later date on any land not planted to maize. Last year, however, owing to the general reduction in crop acreages farmers were enabled to pick and choose their wheat lands. There is no question but that in the past much unsuitable land was seeded to wheat and that this area considerably reduced the country's yield per acre. Land which under normal conditions cannot produce five bags of wheat to the acre is not wheat land.

A review of the varieties grown is of interest. In this connection it should be noted that most varieties contain an admixture of other wheats and once new varieties have become established it will be necessary to keep up a stock of pedigree seed. Farmers who grow more than one variety cannot pay too much attention to the thorough cleaning both of seed drills and of harvesting and threshing machinery. Similarly in seeding, when the seed of one variety is finished, a border should be left before the seeding of another variety is started, as this practise facilitates keeping varieties separate at harvest.

In the higher altitudes wheat No. N.B. 230 A.14 (L), a departmental production, largely replaced Equator. The change over was justified as this wheat, generally known as "Mike's" wheat, is resistant only to form K2 of stem rust, the form generally present at the high altitudes, whereas Equator is susceptible to it. Furthermore, it matures about six weeks earlier than does Equator. At 9,000 feet it had some infection of yellow rust which it escaped in 1932, but this year even Equator itself was by no means free of this rust. It may be that conditions were particularly favourable for yellow rust, or it might have been due to the presence of a different physiologic form. Equator, however, must still be classed as resistant though not immune to this rust.

Both these wheats are heavy yielders and acceptable to the millers. N.B. 230 A.14 (L) lacks the strength of straw of Equator and is prone to fall rather easily. This is especially noticeable on the stronger and richer soils where growth is heavier.

This wheat was also grown at lower altitudes with some success but as it only has the same stem rust resistance as Kenya Governor, that is susceptibility to three forms and resistance only to K2 form of stem rust, it is unlikely to escape rust any more than Kenya Governor is and neither of these wheats can be recommended for these areas.

Kenya Governor did well at altitudes, other than high, owing to the absence of stem rust. This wheat must, however, eventually give way to more rust-resistant varieties. Several fields were seen at the high altitudes badly affected by yellow rust and farmers run a very grave and unnecessary risk of crop destruction by this rust if they persist in growing this wheat at these unfavourable altitudes.

Kenya Standard also did well though the acreage sown was not large, and, if leaf rust is not prevalent, under suitable conditions this wheat is to be preferred to Kenya Governor as it is resistant to three forms of stem rust and only slightly susceptible to the remaining form.

A certain acreage was also sown to Marquis and Burbank wheats. The former has nothing to recommend it in this country as it is susceptible to all forms of stem rust and to yellow rust. The latter is quick maturing and resistant to forms K2 and K3 of stem rust whilst susceptible to forms K1 and K4 and to yellow rust. Both wheats are good yielders.

A few fields of Reward wheat were also grown. This wheat despite its excellent grain quality cannot be recommended as it is completely susceptible to yellow rust and also to stem rust.

Finally there were two other wheats, Sabanero and Nandi, which were grown in some bulk. Sabanero is a South American importation introduced by the Kenya Farmers' Association, Ltd., some years ago and since multiplied up on the Plateau. It was tried in the breeding cage at Mau Summit for several years and finally discarded as being not quite resistant enough to yellow rust at the high altitudes whilst it also had stem rust. In view of the fact that this wheat was being grown on some scale and was reported never to have rusted, seedling inoculation tests were made and these tests showed it to be resistant to all forms of stem rust. Under field conditions at Njoro and exposed to a severe rust epidemic about 20 per cent of the plants were rusted and this wheat would appear to be impure in this respect. Impurities in other respects such as ear and grain shape and chaff colour were also observed and selected strains will be built up.

Sabanero is a quick maturing wheat, though slower than Kenya Governor, and the grain is likely to be suitable for baking purposes. It has grown well, especially under dry and poor conditions, and owing to its stem rust resistance is to be recommended to all but the highest altitude areas where it is too susceptible to yellow rust. Those districts having two rainfall periods in the year such as the Machakos and Nyeri areas could probably sow it with the March rains though it might be too slow maturing to suit the October rains.

It is a bearded wheat possessing moderate to weak strength of straw.

Nandi wheat is of obscure origin. A small amount has been grown in the Nandi country for many years and it was probably originally imported from abroad by a missionary resident there. Nandi is also a bearded wheat and matures slightly more quickly than Sabanero and very nearly as quickly as Kenya Governor. It is also likely to be a suitable milling wheat, and possesses somewhat similar resistance to yellow rust as does Sabanero though it is not quite as good as this wheat in this respect and can therefore not be grown with safety over 8,000 feet. Seedling inoculations showed it to be resistant to three forms of stem rust and on the border line for the remaining form, K1. In the field at Njoro all plants had, however, a fair infection of stem rust and a grower also stated that this wheat had rusted with him in the past.

This wheat, whilst similar in many ways to Sabanero, cannot be considered its equal and there seems little point in continuing with it except where its slightly quicker maturity may be of value, such as at Narro Moru.

Wheat Breeding at Njoro.

The season was a difficult one. Owing to the lateness of the rains the wheats were not sown until the end of May. As soon as the wheats germinated, a further dry period of a month set in which necessitated continuous watering whenever possible. However, good rains subsequently fell, the wheats made good growth characterised by exceptional length of straw and excellent yields were obtained.

The advance reported last year in the production of rust resistant wheats has been maintained and a number of new strains will be issued to farmers for trial and multiplication in 1934.

An artificial rust infection was created by Mr. Thorold, the Mycologist, in the breeding cage and hybrid plots. All four forms of stem rust were utilized and were successfully produced and spread in epidemic form. Mr. Thorold is to be congratulated on having produced, for the first time, a successful epidemic of all four forms of stem rust in the "surround". The only disadvantage resulting from a successful epidemic of four forms together is that it is difficult to know what forms of stem rust are present on any particular hybrid plant which has rusted. However, the presence of all four forms enabled the hybrids to undergo a very severe and embracing test and a number of strains proved most resistant.

Cross No. 112 : *Njoro wheat* × *an English hybrid.*—In this case as in all succeeding ones the "Njoro Wheat" is one of those which had been previously bred at Njoro and which were completely resistant to the various physiologic forms of the three species of rust (or sometimes of stem rust only) but were of poor milling quality. This Cross No. 112 has now reached the multiplication stage and a number of small plots were sown as well as one or two larger areas. This cross is resistant to three forms of stem rust and susceptible to one form (K2). This form appeared late this season but was very severe on appearance. Until then all cultures had shown themselves very resistant to the stem rusts present but with the advent of form K2 a varying amount of susceptibility was noticed. Owing to the size of the pustules present even on the apparently fairly resistant plants, the progeny of Cross 112 must be rated as susceptible rather than resistant to this form though it is not anticipated that it would ever be completely destroyed by this rust as Equator frequently is. In fact as far as stem rust is concerned it is likely to be a very much safer wheat to grow than Equator.

As regards yellow rust, strains bred from this cross can be safely grown up to 8,500 feet, though at 9,000 feet some infection may occur. Some single plant selections, however, grown in the breeding cage at Molo showed themselves sufficiently resistant to this rut to be grown at 9,000 feet. Whether these wheats can be grown at the higher altitudes depends, however, mainly on their behaviour to form K2 of stem rust and field tests alone will be the deciding factor.

In other respects these wheats are excellent. They possess strong straw, mature in 5½-6 months at Njoro, and yield well; a half-acre plot sown at 47 lb. to the acre yielded at the rate of fourteen bags to the acre, whilst other strains on smaller plots gave yields of ten bags and over. Whilst the bushel weight is a great improvement on the original Njoro wheats, they might be still better in this respect. Some few bags of seed are now available and these will be distributed to farmers for trial and multiplication whilst comparative trials will be made at Njoro.

The endeavour to speed up the production of this cross has resulted in some strains not being altogether pure but this will be remedied in due course. In the meanwhile over twenty-five bags of seed of different strains have been harvested, many of which are ready for issue.

Crosses Nos. 117 *and* 122: *Njoro Wheats* × *Marquis.*—These crosses have the same stem rust resistance as Cross No. 112, but they are not resistant to yellow rust over 7,000 feet and should therefore not be grown at the higher altitudes. They would appear to yield well, have straw of medium strength, and 10-20 lb. of seed of a number of strains are available for sowing in 1934. They have been bred as "quality" wheats with Marquis as one parent, and some of the grain has bushelled up to 64 lb., which is a record for wheat grown at the Plant Breeding Station.

Crosses Nos. 130 *and* 131: *Njoro Wheats* × *a Selection out of Australian Florence.*—The former cross was this year grown at the high altitude cage at Molo to test its progeny for yellow rust. Despite a bad epidemic of this rust a number of strains were found to be very resistant whilst the wheats were also exposed to a mild attack of stem rust (Form K2) which allowed of some selection being made. This cross has therefore now been exposed to form K1, K2 and K4 of stem rust and to yellow rust, and a number of cultures resistant to these forms have been obtained. In addition further cultures were also sown at Njoro and plants selected which were resistant to all forms of stem rust. These plants will be grown at Molo in 1934 for a test of resistance to yellow rust. It would appear therefore that there is every possibility of obtaining wheats out of this cross which will be resistant to all forms of stem rust and also to yellow rust at the highest altitudes, and that they could therefore be grown successfully in all districts of the Colony except those requiring a very early maturing type. These wheats have good ears and promising grain, some of the strains possessing hard translucent grain at Molo and bushelling up to 62 lb. despite damage by frost. Their main failing is a tendency not to stand well but it is hoped that this supposed lack of strength of straw will not be serious.

Cross No. 131 was grown in the cage at Mau Summit in 1932 and plants resistant to yellow rust were selected. This year the cross was exposed to infection by all forms of stem rust at Njoro and several of the cultures proved most resistant to them all. A few cultures are therefore available resistant to stem and yellow rust and these will be multiplied accordingly and further tested for yellow rust at the Molo cage.

Cross No. 58 : *Red Egyptian* × *a Kenya Hybrid.*—A few strains out of this cross which were bred at the Scott Agricultural Laboratories and were transferred to Njoro in 1931 were continued at Njoro and one strain possessing good ears and straw proved resistant to all forms of stem rust. It is an early maturer, comparable to Sabanero in this respect, but is susceptible to yellow rust over 7,000 feet. A few pounds of seed are available for multiplication.

Cross No. 142 : *Njoro Wheat* × *San Martin.*—San Martin is a South American bearded wheat very attractive in appearance, but very susceptible to stem and yellow rusts. It is a moderately quick wheat. This cross was only in the F_3 generation and single plant selection for stem rust were made.

Cross No. 146 : *Njoro Wheat* × *Equator.*—This cross, which was in the F_3 generation, was grown at Molo. The majority of the plants proved too susceptible to yellow rust, but a few selections were made. It is not anticipated that any very valuable material will be obtained from this cross, however.

Cross No. 133 : *Njoro Wheat* × *Equator.*—This cross, which is in the F_4 generation, was grown at Njoro and a few rust resistant plants were selected. The grain looks good and these plants will be followed up as the cross has previously been tested for yellow rust at Mau Summit and found satisfactory in this respect.

Cross No. 162 : *Kanred* × *Equator.*—This cross is only in the F_2 generation and rust resistant plants were selected.

The following crosses which are in the F_1 generation were grown :—

K.2.R.5 (L.2) × Reliance.
K.2.R.5 (L.2) × Marquis.
D.2.E.2.C.4 (L) × Selection out of Australian Florence.

Nearly two hundred strains of the Scott Agricultural Laboratories hybrids were also grown at Njoro and at Molo for trial purposes to test their resistance to form K2 of stem rust. As was expected, at the latter station they showed no signs of rust but at Njoro they all proved susceptible to form K4 of stem rust.

Two further hybrids, Nos. B. 256.G.1.A. and U.X. 9.M.1.A., were grown in the Rongai district. The former wheat, like the new Scott Laboratories wheats, is only susceptible to form K4 of stem rust and yielded at Rongai at a higher rate than Kenya Governor grown alongside. Over fifty bags of seed are available for sowing in 1934. Wheat No. U.X.9.M.1.A. did not do so well at Rongai as B. 256. G.1.A., but, owing only to its superior resistance to stem rust (being resistant to all forms), it will be given a further trial and milling tests will be made. Incidentally it is favourably reported on from Tanganyika Territory.

Wheat Breeding at the Scott Agricultural Laboratories.

It will be recollected that the recent series of hybrids were all unfortunately found to be susceptible to the latest discovered form of stem rust (K4) which was the natural corrolary as none of the parents possessed complete resistance to this form. It was felt, however, in view of the fact that these wheats had other very desirable agronomic qualities, and that form K4 was not likely to appear every year, that they would still be of value in particular for those areas which required a very quick maturing wheat. Like Kenya Standard they are resistant to the remaining three forms of stem rust whilst in addition they also possess considerable resistance to leaf rust and in every other way are all far superior to this wheat and of course also to Kenya Governor. Accordingly they were grown on in the long rains and subjected to further selection. They withstood the dry season experienced at the Scott Agricultural Laboratories admirably and a reasonable amount of seed was harvested. Further multiplication on a large scale was carried out in the short rains, some twelve acres being sown in October, so that a number of bags of seed of some strains should be available for issue and trial in 1934. But for two such adverse growing seasons multiplication would have been even more rapid and the thanks of the Plant Breeding Services are due to Mr. S. Gillett, the Agricultural Officer in charge of the Scott Agricultural Laboratories, for his help in this matter. Stem rust was absent throughout the year in the field, but this did not matter as the wheats had already undergone sufficient test in this respect.

These wheats are largely the progeny of two particular crosses: Nos. 59 and 60. Both had Kenya Standard as one parent and a high-yielding, leaf-rust resistant Kenya hybrid wheat as the other. Whilst the progeny of both possess a smallish, roundish amber berry, that of Cross No. 60 would appear to be more desirable to the miller and special attention will be given to its production on a large scale.

Some of the hybrids which appeared in Kenya Standard have also been carried on and a few selected lines have now reached the bag stage. These wheats whilst possessing the same stem rust resistance as Kenya Standard are in other respects, including resistance to leaf rust, much better and they also promise well from a milling point of view.

The position therefore is that strains out of Cross No. 60 in particular and out of the natural hybrids found in Kenya Standard seem likely to be suitable milling wheats. These strains are now in some small bulk and small issues will accordingly be made in 1934. Their main fault is their susceptibility to form K4 of stem rust but even so they should be able to replace Kenya Standard and Kenya Governor with advantage. A great amount of time and labour has been spent on them, largely due to Mr. Noble's efforts, and it will indeed be unfortunate if their future is to be undermined by severe annual attacks of this one particular form of stem rust.

To deal with this form a fresh series of nineteen crosses was made by Mr. Noble. Wheats Nos. K.2.R.5 (L.2) and U.X.9.M.1.A.9.D., Sabanero and Reliance were utilized as the stem rust resistant parents and these wheats were crossed with strains out of Crosses Nos. 59, 60, 73 and one of the Kenya Standard hybrids.

The crosses were harvested in August and the F_1 generation sown in October, so that in the case of those crosses in which one parent is resistant to all four forms of stem rust and the other to three forms it should not be too long or difficult a matter to produce completely resistant strains making use of the two seasons a year which are available at this sub-station. Some of the F_2 selections out of the longer-maturing crosses will be transferred to Njoro in the future.

The Breeding Cage at Molo.

This cage, which for some years previously was located on Major Drought's farm at an altitude of 8,500 feet, was moved to Capt. Soames' and Mr. Pell Smith's farm (Marindas Farm) at Molo at an altitude of 9,200 feet. The colder temperature and greater humidity obtained at this altitude proved, as was expected, most beneficial in producing more favourable conditions for the incidence and severity of attack by yellow rust, and all plants which show resistance under these conditions may indeed be called resistant. It is gratifying to be able to report that a number of such plants have been found.

Thanks are due to these gentlemen for the free supply of labour in erecting the cage and for their help and interest in the work undertaken.

MILLING AND BAKING QUALITY OF THE NEW WHEATS.

This is a very big problem which is dealt with in many countries by special institutions designed to carry out baking quality tests on small quantities of wheat. These institutions are not available in this country, thus seriously adding to the many difficulties experienced here in successful wheat breeding. All that the plant breeder can do himself is to ensure that one of the parents of the crosses he has utilized possesses grain of suitable milling and baking quality. Subsequent grain selection is largely guess-work although hard vitreous well shaped grain is naturally chosen wherever possible and chewing tests can be made.

Marquis and Australian Florence were used as parents in some of the crosses largely for improving milling quality and all single-plant selections are subjected to a grain examination before the next season's sowing.

Through the courtesy of the Kenya Grain Mills use was made of their consulting chemist, Professor Kent-Jones, to whom seventeen grain samples from the more advanced strains were sent. Thanks are due to Mr. Holden, the general manager of the Kenya Grain Mills, for his help and advice in all matters relating to this side of the wheat industry.

The reports on some of these grain samples are distinctly promising. The protein content of all was very high but in many cases the balance between stability and general strength was not quite satisfactory, the stability figure being rather too high for the general strength. In general, the best of them possessed very good general strength, high stability and good elasticity though they were a little lacking in destensibility.

Cross No. 112.—The samples out of this cross filled the top and bottom places in order of merit which is an example of how difficult it is to judge the grain by appearance alone. The top sample might be compared to a reasonably good Manitoba grade.

Crosses Nos. 117 *and* 122.—These samples filled the second and third places in order of merit and it would appear that the Marquis quality of grain has been retained in these strains.

S.A.L. Pure Lines.—Cross No. 60 and a selection out of the Kenya Standard hybrids occupied fourth and fifth places and show definite promise.

Sixth place was occupied by wheat No. B. 256 G. which is now being grown on a small scale and this wheat would appear to be of some value to the miller. Whilst too much reliance cannot be placed on the result of one laboratory test only, the results indicate that success in this problem may be achieved in the future.

In addition to the milling tests made by Kent-Jones which require 3-4 lb. of grain and are naturally limited in number, a start is being made in trying Pelchenke's test, which is a wholemeal fermentation time-test of the baking quality of wheat. This test is particularly suited to wheat-breeding methods as the amount of grain involved is very small, the grain of one plant being sufficient. The Chemical Section of the Department has undertaken to try out this test which it is anticipated will prove of considerable value to the Plant Breeding Services.

Physiologic Forms of Stem Rust.

No new physiologic form of stem rust has been discovered during the year under review. It was hoped that the last discovered form, No. K4, would confine itself to the lower altitudes but this unfortunately has not been the case, its presence having been found on wheat on the Plateau, and at Ainabkoi, Njoro and Rongai, though in no case was much damage done.

Whilst form K2 is and has generally been the main form prevalent at the higher altitudes, the question as to the frequency of appearance of each or all of the other forms in any particular area is still uncertain, and more data are required before these forms can be correlated with altitude or locality. Forms K1, K2 and K3 are very rarely found at the highest altitudes, though form K2 is occasionally present at the lower altitudes. Forms K1, K3 and K4 can and do all appear at the lower altitude districts, either together or singly.

In the production of the new rust resistant wheats of good milling quality use was made, as one parent, of some of the first Njoro hybrid wheats, bred by this Department. These latter wheats possessed resistance to all physiologic forms of stem rust and their only real fault was poor milling quality. It has been found that little difficulty has been experienced in transmitting resistance to forms K1, K3 and K4 of stem rust, but the successful transmission of resistance to form K2 has been a very different and more complex matter. In some crosses resistance to this form was obtained as easily as resistance to the others, but in the case of other crosses complete resistance has not been obtained. Examples which can be cited are those of N.B. K.2.R.5 (L.2) × Marquis and N.B. K.2.R.5 (L.2) × English hybrid, in which some susceptibility to K2 was shown by all the progeny, though these possessed complete resistance to the other forms, whereas in the case of N.B. K.2.R.5 (L.2) × Florence resistance to this form as well as to the other three has been acquired by some of the progeny, though Florence and Marquis are equally susceptible to all forms of stem rust.

The limited staff at the Plant Breeding Station, and the experimental work, other than plant breeding, carried out there has prevented genetical research into the problem of inheritance of resistance to form K2 or anything else. The transference of resistance to this form has been achieved, however, by making large numbers of crosses of which one parent possesses of course the necessary resistance to form K2, as it was thought that some at least of the crosses would prove successful in this respect.

LABORATORY TESTS OF STEM RUST RESISTANCE.

Stem rust inoculations of selected seedling plants were again carried out by Mr. Noble in collaboration with the Mycological Section. These seedling inoculations can only serve as a guide as to the behaviour of the plant in the field and too great a reliance must not be placed upon them. They are, however, of great use in determining the likely behaviour of introduced and hybrid wheats to stem rust and the form or forms of stem rust present in any particular locality.

MATURE PLANT RESISTANCE.

A further trial was made this year of those few of the Canadian group of wheats which, possessing a "mature plant" resistance to stem rust in that country, had also shown resistance in the field in this country. The wheats in question were Double Cross × Ceres 720, Double Cross × Ceres 721, and Hope. Exposed to a severe artificial epidemic of all four forms of stem rust these wheats definitely showed resistance, whereas Marquillo and H.-44-24 × Marquis, grown alongside as testers, showed slight susceptibility though these latter two wheats belong to the Canadian group. Unfortunately, however, these wheats seem rather susceptible to black chaff under Kenya conditions and on this account Double Cross × Ceres 720 will be discarded as it suffered badly from this disease both at Njoro and Molo. Further trials will be continued with the other two wheats. Double Cross × Ceres 721 possesses some resistance to yellow rust and can probably be grown up to 8,000 feet but Hope should not be grown over 7,000 feet. The grain samples obtained, whilst hard and translucent, have yet to approach in appearance those obtained under Canadian conditions.

Recent work in Canada has, however, shown that the resistance to stem rust possessed by Marquillo and Double Cross in the field is no different from that shown by seedling inoculations in the greenhouse, and that these two wheats do not therefore really possess any "mature plant" resistance, as opposed to physiologic resistance, such as is shown by H-44-24 and Pentad. It is too early as yet to more than note the conflicting results obtained in this country.

DISEASES.

Other diseases as well as rust were not very prevalent. Take-all has done some small damage and this disease was also observed at Kipkabus, Ainabkoi and at the Plant Breeding Station, Njoro. It was not anticipated that it would appear at the Njoro altitude of 7,100 feet but wheat growers at the medium altitudes must in the future be on the watch for its appearance. Much of the Molo/Mau Summit area affected in 1932 was rested from wheat in 1933 and it is hoped that farmers will gradually be able to work in some form of rotation which will obviate the growing of wheat successively on the same land for too long a period. In this connection the experiments laid down on the Molo plot of establishing temporary grass leys, using wheat as a nurse crop, were most promising and this very important work should facilitate both the control of this disease and the change over to mixed farming. It is urged that the take-all control measures advocated be rigidly adhered to and that the disease be treated with the greatest respect and care in order that it may be completely eradicated. It is possible that the long dry season experienced in 1933 prior to sowing may have helped to keep it in check and that conditions were unfavourable to its spread.

Black chaff still remains a potential danger and suitable control measures have yet to be evolved. Varieties certainly vary in their susceptibility and in all breeding work attention is given to this point when selecting plants.

The use of one of the mercurial dusts at present on the market for dressing seed has been advocated as giving increased yields not so much by checking disease as by providing a tonic or stimulant to the growing crop, and an experiment will accordingly be laid down with these dusts to test this theory in 1934.

A collection of thirty-two wheats was received from Egypt and sown at the Scott Agricultural Laboratories, at Njoro and at Molo. The majority of these wheats were of the Durum species and, whilst some of them showed resistance to stem rust and others again to yellow rust, not one variety combined in itself sufficient desirable characteristics for use in this country. Since there is a small local demand for about 10,000 bags per annum of a durum wheat for the atta trade, the country needs a good rust resistant one. If time permits, steps might be taken to breed a good yielding rust resistant durum from the material available.

Some of the new rust resistant wheats have been sent to Northern and Southern Rhodesia and to Tanganyika Territory for trial. New South Wales, Australia, has periodically also received some of the new strains and the Director of Plant Breeding in that State reports that "these wheats have been found to be amongst the most valuable material we introduced on account of their high resistance to stem rust." It would appear likely, therefore, that one or more physiologic forms of stem rust present in New South Wales and in Kenya are common to both countries.

MAIZE BREEDING.

The work on this subject at Njoro is devoted mainly to producing types of maize suited to the higher and colder altitudes of the Colony, but attention is naturally also paid to general disease resistance. The methods adopted for the work and the observations as to abnormalities were similar to those described in detail by Mr. Maher, Agricultural Officer, Kitale. The Trans Nzoia is, from the climatic point of view, a real maize area so that the maize breeding work is chiefly devoted to producing types resistant to disease, especially *Helminthosporium turcicum* and *Fusarium* diseases. As Mr. Maher points out, considerable difficulty is experienced in breeding plants resistant to the latter group of diseases. At the Scott Agricultural Laboratories attention is devoted to producing a very early variety of maize suited to the adjoining native reserve of the Central Province.

Njoro.

Thirty-eight F_2 lines were planted following the fine heavy rain towards the end of May. During the dry spell experienced in June a portion of each line had to be watered which added considerably to the work of the staff. At flowering time a further period of dry weather was experienced and though over two hundred plants were selfed, the percentage of grain set was small. Apart from what is known as the Njoro type of maize which possesses grain which has a slight dent and a hard translucent appearance, a further type is segregating out both in the inbred lines and in the field maize. This type has little or no dent and is much more flinty in appearance and of an amber rather than a white colour. The merits of these two types will be tested out in the maize seed competition in 1934, but it can be said now that both types would fall into the grade K2 Flat White.

Trans Nzoia.

Mr. Maher's report follows :—

Breeding Material.—The breeding maize was planted at Kibonet, Kitale, by kind permission of Estates and Investments, Ltd., Kitale. Ninety F_3 lines, 135 F_2 lines and five small blocks of mixed remnants of cobs of the F_3 generation were planted.

The selfing was carried out by Mr. Gamble, and occupied him from the middle of July till the middle of September. At the end of the year, having rejected cobs obviously affected by ear-rotting organisms, there remained 122 F_4 cobs, 215 F_3 cobs and thirty-nine F_3 cobs derived from the blocks of mixed remnants of cobs; in addition there were six cobs of the F_3 generation selected for susceptibility to white blight (*Helminthosporium turcicum*. Many of the cobs will be rejected on grain characters prior to planting in 1934.

Routine.

A very satisfactory plan of work was evolved for annotating the selected plants at the time of selfing. Each row in which plants had been selected had a white rag tied on the end plant, together with a tin label on which was recorded the number of selected plants in the row and, subsequently the dates on which the tassels were covered. When the various plants were selfed the date of covering was erased on the label at the end of the row, while the date, hour, and method of selfing was noted on a label which had been tied to the selected plant previously. The rows were numbered in succession to avoid using the lengthy pedigree number and the selected plants were numbered in the row, the appropriate pedigree number being written on the label of the successfully fertilised cobs at harvest time.

After selfing and before the plants commenced to dry off the heights were measured to the nearest 6 inches, measuring to the lower flowers of the tassel, and the leaf widths and stem thicknesses were given a number of 1, 2 or 3 according to whether narrow, medium, or thick. In the case of leaf widths the three classes were under 4 inches, 4 inches to 5 inches, and over 5 inches respectively; the leaves were measured at their broadest points. The plants were given marks from 0 to 10 for their characters in relation to resistance to *Helminthosporium turcicum*, *Puccinia zeae*, and *Fusarium* spp. Nought indicated apparently complete susceptibility for all practical purposes, and 10 indicated complete resistance. In the case of *Helminthosporium turcicum*, two marks were taken off for each sorus found on the top half of the plant and one mark for each sorus on a lower leaf.

As in 1932 a marked degree of resistance to the two former diseases was observed in certain lines but not many lines secured high marks for resistance to the *Fusarium* group of organisms. Selection of resistant plants is complicated in the latter instance by the fact that infection is slight at the time when the plants are selected, which is necessarily before flowering, and develops as the plants mature after selfing, especially when the rainfall is heavy during the second half of the lives of the maize plants.

It was very obvious that lines which did not receive high marks for vigour early on, at about six weeks old, did not show themselves to be desirable at a later stage; similarly plants which received low marks for disease resistance just after selfing rarely produced cobs of any value.

On the whole the breeding maize had a high proportion of stalks standing up well at harvest.

Abnormalities and diseases other than those noted above.

One or two F_2 lines showed a high proportion of complete dwarfs which only grew to 9 inches or 1 foot high. One row had sixteen dwarfs in seventy-one plants; and doubtless many of the dwarfs had been removed when the row was thinned. Two other rows, also of the F_2 generation, gave a relatively high number of semi-dwarf plants in which the internodes were much reduced while the leaves on the plants, which were only 3 inches to 4½ inches high, were exceptionally broad and short.

Many specimens of diseased maize plants were sent to Mr. Thorold, the Acting Senior Mycologist, for examination during the course of the season. Several plants were noticed which appeared to be suffering from a virus disease or "streak". A soft rotting condition of the stalk, in which saprophytic bacteria and yeasts were present, leading to a strong odour of fermentation, was probably due to one or more *Fusarium* species which were not definitely identified. The cause of a dark greasy spot on the mid-ribs of the leaves which grew and finally led, in many plants, to the leaves snapping across at that point, has not been determined by the Mycologist. *Alternaria* and other fungi and bacteria of doubtful parasitism were found on various leaf spots which were very general in 1933 but the cause of which remained uncertain, though there was a definite genetical differential susceptibility. At harvest a cob showing the typical dry rot due to *Diplodia zeae* was collected together with several light chaffy cobs suffering from *Nigrospora oryzae* which is probably the same as the *Basisporium gallarum* of American literature.

Every year there are a number of cobs suffering from *Nigrospora* spp. to be found in Kenya maize, but this year is the first year in which I, personally, have found cobs suffering from Diplodia dry rot which does considerable damage in maize in the U.S.A., South Africa and Rhodesia; though in the latter country various *Fusarium* ear rots are loosely spoken of under the popular name of "Diplodia" as well as the true *Diplodia zeae*. Another very characteristic Diplodia dry rot cob was found casually on the departmental experimental plots on Capt. Elmer's farm; so it is very possible that this disease is on the increase.

Flowering Habits of Maize in the Trans Nzoia.

Observations were made by Mr. Gamble on twenty-one plants with regard to their flowering habits. Although this work should be repeated on at least one hundred plants in order to give an idea of the range and frequency of the different rhythms of flowering, a few data are given here to illustrate some of the difficulties which have to be met in the course of the maize breeding:—

The maize was planted on May 1st and 2nd.

The pollen appeared two to fourteen days after the tassel showed, lasted seven to twenty-two days.

The silks appeared from three days before to thirteen days after the pollen began to shed.

The pollen ceased to be shed from one day before to twenty-seven days after the silks appeared.

In the twenty-one plants the tassels appeared from July 27th (86 days) till August 18th (109 days).

The pollen began to be shed from July 31st (91 days) till August 23rd (113 days).

The pollen finished shedding from August 15th (106 days) till September 9th (130 days).

The silks appeared from July 31st (91 days) till August 23rd (113 days).

Of the twenty-one plants, eight showed their silks before their own pollen appeared and two on the same day as pollen began to be shed.

No information is available as to the length of viability of an individual pollen grain under the conditions of moisture and temperature current in the Trans Nzoia.

SCOTT AGRICULTURAL LABORATORIES.

Under the care of Mr. Gillett at the Scott Laboratories, work was continued on a type of white dent maize called Muratha which is being bred and improved by selection (not by selfing) for resistance to white blight and for early maturity. Early maturity is of paramount importance for the natives in the adjoining Kikuyu Province, where the rainy seasons are short—a condition aggravated by the high altitude and the shortness of the daylight hours on the equator. Considerable progress has been made in this work and Muratha maize now yields about 50 per cent better than the ordinary native maize. The work was very much handicapped during 1933 owing to the drought.

CROP TRIAL AND CROP IMPROVEMENT WORK.

Comparative varietal trials along statistical lines of a number of crops are a feature of the work of the Plant Breeding Services but as this work is so closely bound up with that also undertaken by agricultural officers in European areas no reference will be made to it here as the work done on it during the year will be found in the section of the Annual Report of the Plant Industry Division headed "Agricultural Services in European areas".

R. J. LATHBURY,
Acting Senior Plant Breeder.

COFFEE SECTION

REPORT OF THE SENIOR COFFEE OFFICER

ADMINISTRATIVE AND EXTENSION WORK.

Enquiries by correspondence to the number of 450 received the attention of the section.

There was travelled on Government duty, by Mr. McClelland and myself, 5,741 miles.

Personal interviews in my office numbered 552.

I attended seven meetings of the Coffee Board, while Mr. McClelland attended three meetings as Acting Secretary to the Board. In the Songhor and Trans Nzoia districts, three and two meetings respectively were held during my visits to these districts. The annual Coffee Conference was also attended.

A total of 116 plantations was inspected during the year as follows: Upper Kiambu 10, Kiambu 24, Songhor 14, Trans Nzoia 14, Ruiru 16, the balance being scattered throughout the country.

Visits were made to the native areas of Meru, Embu and Kisii and separate reports submitted in connection with native coffee growing.

Permits were issued during the year for the importation of 687 lb. Blue Mountain coffee seed from Jamaica, and 15 lb. Kent's from Tanganyika. Specially selected Kent's seed has also been ordered by the department from India.

Numerous parcels of parchment coffee for seed purposes were inspected for pests and diseases by officers of the section.

Coffee Planters' Day.

I dealt with the following topics at this meeting: pruning, spraying, mulching, observations made on washed-out coffee root systems and the root system in relation to manuring.

During the afternoon parties were conveyed round the Scott Laboratory grounds by guides, and demonstrations were given on various points in connection with the coffee industry. The attendance at these demonstrations was very gratifying, approximately three hundred planters being present.

Agricultural Shows.

Two agricultural shows were held during the year, at Nakuru and Nairobi, for which exhibits were prepared, while officers of the section were also in attendance. I acted as one of the judges in the coffee section at the latter show.

General.

The prospects, early in the year, for a record Kenya coffee crop were extremely promising, but the prolonged drought which resulted from the failure of the long rains severely affected the development of the crop resulting from the early flowering, and it has also done extensive damage to the late flowering, except in some of the wetter districts, which to some extent are served by occasional rains due to local conditions.

Some plantations in the districts affected by drought promised crops at the rate of ¾ ton to 1 ton per acre, but in consequence of this drought the yield was very low, the quality of the crop was seriously affected and the trees suffered from dieback and in certain cases from thrips.

The lack of moisture has enlightened many planters as to the shallow parts of their plantations and has also shown up those parts which are in a poor state of fertility. It was most noticeable that thrips first appeared where the above-mentioned conditions were present.

When thrips began to give cause for alarm a few planters took the precaution of spraying with lime sulphur, and the infestation was arrested by mid June which coincided with the advent of light showers and cold weather.

Early in the season it was stated by certain merchants that, although the appearance of the finished article would be affected by the abnormally dry conditions, the quality would be an improvement over the previous year, and it was described that the liquor would be more concentrated, or some such reason. Such views cannot possibly be based on practical experience as some of the finest liquoring coffees of the world are produced under a heavy rainfall. The highest prices paid for Kenya coffee during 1933 were for coffee grown in districts where rainfall has been adequate. It is not suggested in this report that the only factor in quality is rainfall, as experience has taught us that there are many other factors to be taken into account. Adequate or heavy rainfall does not necessarily mean that a plantation bearing an *abnormally heavy crop* produces coffee of a good liquoring quality, as it has been noted that adverse reports have been given when the trees have borne an abnormally heavy crop.

Although the production of coffee is in excess of consumption it would appear from market reports that if Kenya can produce an attractive coffee with good liquoring qualities it will always command a high price. The difference of price between A and B grades is out of all proportion when one considers from the same plantation they are the same coffee, merely differing in size through mechanical sorting.

CO-OPERATIVE EXPERIMENTAL AND INVESTIGATIONAL WORK.

Mauring.

Owing to prolonged drought, observations on manurial treatment carried out on individual plantations were abandoned for the year.

Vertical Forking.

In some of the wetter districts a few planters carried out vertical forking early in the year. This has had a most beneficial effect on the coffee bushes due to the aeration of the soil and to increasing the depth of humus.

On one plantation where the rainfall had been moderately good the task completed for this type of cultivation by forking in a circle round the drip was one hundred trees per boy per day. On another plantation where rainfall was scanty a boy could not do more than twelve trees per day. In the latter case, however, all the ground was forked.

It is hoped that vertical forking will be adopted generally throughout the coffee growing districts as results to date warrant this treatment. It must, however, be accompanied by prevention of soil-wash.

Thatching.

In the drier districts it is essential to conserve all available moisture and therefore planters are being advised to adopt thatching as a method of achieving this. The year under review was admirable for making observations on this practice and results showed that in each case where thatching was carried out the coffee bushes showed little or no effect from the drought.

If thatching is adopted it will be obvious that the roots will be obtaining the greater part of the nutrients in the top soil, and therefore this soil must be kept in a high state of fertility and it is suggested that vertical forking is an ideal method of incorporating surface applications of manures into the soil in order to attain this.

Green Manures.

Trials are still being continued with green manures and cover crops; the drought, however, has been so severe that it has greatly affected their beneficial uses and the observations on their behaviour.

Seed samples of the following green manures and cover crops have been issued for trial during the year :—

Field peas, PBI/P/50.
Dixie Soya bean.
Brownie Soya bean.
New Zealand Grass pea.
Salmon Marked Lima bean.
Black Mauritius bean.
Glycine javanica.
Centrosema pubescens.

Calopogonium orthocarpum is deserving of more extensive trials, but this has not been possible to date, owing to the scarcity of seed.

Pruning.

The pruning and manurial experiment designed in 1932, on a plantation in Ruiru, by the Senior Agricultural Chemist and myself, with the object of determining (*a*) pruning in relation to flowering, and (*b*) manuring in relation to flowering, was inspected during the year, but owing to the abnormally dry season it was considered inadvisable to record any observations other than those which have been noted by the owner. It has been decided to repeat this experiment during the forthcoming season.

Two plantations, one in upper Kiambu and one in Nandi, have been selected for the carrying out of pruning experiments on the multiple stem system with the object of demonstrating the most suitable method or methods of establishing second and subsequent cycles.

It might be of interest to state here that it is my considered opinion that, in districts where the multiple stem system of coffee growing could be carried out with satisfactory results, planters will not only regret changing from the multiple to the single, but will desire to revert to the multiple in the near future, more particularly if the price of Kenya coffee does not improve.

On many plantations the failure of the multiple stem system is not due to the system itself being unsuitable but to the irregular and haphazard treatment to which it is subjected. I do not wish to imply that multiple stem should be adopted generally as I am of the belief that under certain conditions in Kenya, single stem is more suitable.

I must once again criticize the method so frequently adopted by a large number of planters, namely pruning coffee bushes which are in a state of debility or are practically leafless and showing no sign of recovery During the period under review considerable pruning was carried out on bushes which at the time were in a wilting condition.

Stumping.

In districts where stumping is carried out and where white ants are prevalent planters are strongly advised to apply a dressing to the wound (*see* Investigational Report, Scott Agricultural Laboratories, appended, for substances recommended).

Extensive damage is being done at the present time by the ravages of white ants on stumped coffee and it is felt if this condition is not remedied it will necessitate replanting large areas of stumped coffee in the near future.

Shade.

Shade trials are being continued in those areas where it is considered necessary. The most recent additions in these trials are Mororowet, *Acrocarpus fraxinifolius* and *Dalbergia assamica.*

Mororowet, which is an indigenous tree in the Nandi Reserve and possibly elsewhere in the Nyanza Province, is showing good promise and may be of great value as a semi-permanent shade tree.

It is yet too early to make any special comments about Dalbergia and Acrocarpus, but the latter is in great demand owing to its rapid growth. In addition to the above-mentioned the following are still under trial and show promise of good results in various districts :—*Cordia holstii*, *Milletia oblata*, *Ficus* sp. (two varieties). Sesbania is still popular with a large section of coffee planters where the necessity for shade arises. Some planters are even so satisfied with this temporary tree that they make no attempt to establish permanent trees.

Calpurnea aurea.—A medium-sized tree of the semi-permanent class is favoured in some districts, but is subject to defoliation by caterpillars, which is a distinct disadvantage.

Castor oil bush.—This bush is being used by certain planters in the Nyanza Province for temporary shade. In my opinion it is unsuitable for the purpose. Its habit of dying out rapidly, thus leaving the coffee bushes suddenly exposed, brings about a yellowing condition of the coffee bushes. During the first twelve to eighteen months (where shade in coffee is beneficial) the coffee looks well under the castor tree but subsequently its effects are noticeable.

Thanks to the cooperation of Mr. Walter, Director of Meteorological Services, and Mr. H. O. Hemsted, Soy, a meteorological station has now been erected on Mr. Hemsted's farm, in order to study the variations of temperature in shaded and unshaded coffee, particularly in relation to artificial shade.

Bordeaux Spraying.

Owing to the drought conditions observations on a number of proprietary sprays and also on spraying at different periods of varying strengths in some of the lower districts, were discontinued.

It was observed, however, that when coffee in a wilting condition was sprayed, scorching occurred and the crop broke down more rapidly than on the unsprayed tree. Shortly after the short rains observations on certain plantations showed that the sprayed trees made a more rapid recovery. Where drought conditions were particularly severe, trees which had borne a moderately heavy crop and which were not sprayed suffered severely from defoliation.

Certain planters in the Nyanza Province are carrying out seasonal spray trials in order to ascertain the most economical strength of spray to use and to study the best period for application.

Since spraying is adding to the cost of production, planters are advised to adopt satisfactory machines and see that the work is efficiently carried out, and if this is done it is felt that the additional cost will be more than justified by increased yields.

In India it was stated that spraying coffee plantations with Bordeaux mixture and various adhesives has given on the average more than double the crop harvested from unsprayed blocks.

DEPARTMENTAL EXPERIMENTAL AND INVESTIGATIONAL WORK.

Elgon dieback.

This disease was brought to my notice for the first time towards the end of 1932. In December, 1932, I inspected two affected plantations on Elgon and in both cases noticed that the disease occurred severely on unshaded and exposed coffee, while on the same plantations under uniform shade the coffee was not affected. In 1933 Mr. Thorold, Acting Senior Mycologist, and Mr. Maher, Agricultural Officer, Trans Nzoia, carried out investigational and observational work in connection with this disease and both confirm in the main principles my original observations that it is favoured by lack of shade and exposed situations.

Coffee Berry Disease.

Investigational work in respect of coffee berry disease is being continued in Sotik under the direction of Mr. H. Wilkinson, and a separate report is being published. The incidence of this disease has not been so severe this year, the primary reason given for this being the abnormally dry season which most districts have experienced. There was one exception to this, namely a plantation in Nandi where the disease reached alarming proportions, soon after a severe hail storm. A manager of a coffee plantation in Nandi has expressed the opinion, that from the results obtained during 1933, by spraying with carbide-Bordeaux at regular intervals, coffee berry disease can be effectively controlled. However, spraying as a matter of control has, judging from the experience of other planters, been very unsatisfactory.

Coffee Roots.

Advantage was taken during the year of washing out root systems in a few districts. A separate report on the observations has been prepared and will be published in the form of a departmental bulletin. It will be appreciated that work of this nature should receive a great deal more attention than I can give to it personally. The object of this investigation into the root system of the coffee plant is to obtain a more concise knowledge of the plant and its behaviour under different conditions of soil, climate and manurial treatment.

Experimental Plots, Trans Nzoia.

Advantage has been taken this year of the start of a small experimental plot near Kitale in the Trans Nzoia to lay down there an experimental patch of coffee, the work on which is under the direct supervision of the Agricultural Officer of the district. Funds at the moment do not permit of its rapid development but it is hoped that in time the results of the experiments conducted on this plot will be of inestimable value to the district.

At present the experiments include :—

- *Coffee Varieties.*
    - Mysore.
    - Mocha (French Mission).
    - Kent's Hybrid.
    - Kenya Selected (Series A).
    - Harar.
- *Shade Trees.*
    - "Mororowet" (Nandi).
    - *Acrocarpus fraxinifolius.*
    - *Grevillea robusta.*
    - *Cordia Holstii.*
    - *Dalbergia assamica.*
    - Elgon Croton.
    - *Machaerium tipu.*
    - "Muguli" (*Sesbania* sp.).
    - *Leucaena glauca.*
- *Bush Shade.*
    - *Tephrosia candida.*
    - Legume indigenous to Mt. Elgon (*Tephrosia* sp?).
    - *Cassia* sp.
    - Pigeon Pea (*Cajanus indicus*).
    - *Crotalaria* spp.

INVESTIGATIONAL WORK AT THE SCOTT AGRICULTURAL LABORATORIES.

The following is the report of Mr. S. Gillett, the agricultural officer in charge.

The area under coffee remains the same as for the previous year. Attempts have been made to plant up further small areas but drought conditions have caused severe losses.

Drought conditions and heavy pruning on both the multiple and single stem blocks early in the year reduced the yield of coffee considerably; an average of only 3 cwt. per acre was picked off the seven acres of productive coffee.

Experiments.

Multiple versus Single Stem.

The comparison between the yields from the multiple stem block and single stem block is of especial interest this year as for the first time in five years the latter has exceeded the former. This was to be expected as new sucker growth was being encouraged on the multiple stem system and little bearing wood for the last season's crop had been left. Climatic conditions undoubtedly favoured the single stem system as the majority of the crop harvested last year was from an October flowering, which was much heavier in the single than multiple stem. No flowering, due entirely to drought conditions, occurred during March. It is believed that if there had been normal conditions throughout an average flowering would have occurred in the multiple stem block, which might have materially altered the results.

The yields were as below :—

Single stem : 4 cwt. per acre (parchment coffee).
Multiple stem : 1 cwt. per acre (parchment coffee).

The table below records the yields per acre obtained over a period of five years :—

	1929	1930	1931	1932	1933	Average
	Cwt. per acre	*Cwt. per acre*	*Cwt. per acre*	*Cwt. per acre*	*Cwt. per acre*	*Cwt. per acre*
Single stem ..	6·8	1·3	4·6	3·8	4·0	4·1
Multiple stem ..	9·0	2·0	8·3	5·4	1·0	5·16

The multiple stem, it will be noted, still shows an increase of 1 cwt. per acre, or 25 per cent over the single stem.

These crops have each received a number of varying experimental treatments such as stripping, pruning, etc., in order to study the ultimate response of the plant. There is no doubt that these treatments have reduced the crop during the year of their application, therefore when studying the average yields the experimental treatments must be taken into account.

Manuring and Cultivation.

The following blocks received a dressing of boma manure during the year :—

Block	Acreage	Amount
	Acres	*Tons per acre*
Plot 14	2	7½
Plot 21 (Single stem)	2½	7½
Plot 24 (Spacing trials and varieties).. ..	1	10
Plot 18	½	10

At the time of application of the manure the plots received a fork hoeing, deep in between the trees and very shallow under the trees. Subsequent to this only surface weeding has been carried out.

Pruning.

(*a*) *Heavy pruning versus parrot-perching of neglected trees.*—This demonstration, which was discussed in its initial stage in the last report, is worthy of further comments this year. It will be recalled that at the end of 1932 the "heavily pruned" trees were carrying more bearing wood than those which had been parrot-perched. Unfortunately, drought conditions affected the observations considerably, but nevertheless the difference between the two methods of pruning was remarkable. Before handling, early in 1933, the parrot-perched trees appeared rather misleading inasmuch as an excessive amount of young luscious vegetative growth had been produced. On handling, however, it was found that the majority of this growth was of no value and the tree was ultimately left with little bearing wood and even that tending towards the "umbrella" habit.

The "heavily pruned" trees were an entirely different proposition. Good, strong new growth had been produced on the old leaching primaries, left the previous year. After carrying out a light pruning—consisting of cutting away old whippy wood and thinning new growth—the trees were left in good shape and with a considerable amount of young bearing wood. In spite of the drought, a small crop was picked off these trees last year and had normal conditions prevailed there is no doubt that this would have been considerably increased.

(*b*) *The effect of time of pruning or fruiting.*—A repetition of these observations was commenced during the year and will be continued until definite conclusions have been reached. The Kent's variety on Plot 21 has been set aside for this work and two rows are being pruned monthly, the first two rows being pruned in October.

(*c*) *Multiple stem pruning.*—The changing over from the first to second cycle on the trees in our multiple stem block at this station has brought to light several problems which require further investigations. This work is already in hand but it will of necessity be several years before conclusions can be drawn.

(*d*) *Stumping.*—A further trial with preservatives as a protection to the cut surface of a freshly stumped tree was carried out. Again it was found that Melanoid was preferable. Although it has been suggested that this preparation is too expensive for the purpose, it is believed that the small extra cost is worth while.

Coffee Manuring Experiment.

Each plot received its dressing of manure as prescribed during the early part of the year. Careful observations have been kept throughout but up till the end of the year no visible results could be determined. It was not expected that the difference would be very marked until several years had elapsed.

Coffee Spraying Experiments.

Further extensive trials were carried out during 1933; unfortunately, owing to drought conditions, little results were obtained. The following observations on trees which had been stripped and carrying no crop, taken at the end of the year on certain sprayed and unsprayed plots are, however, of interest :—

Plot 1.—Control—unsprayed : foliage sparse, fair flower bud formation.

Plot 2.—Sprayed—1 per cent Carbide-Bordeaux, one spraying in March : very marked general improvement over Plot 1; foliage healthier in appearance and denser; flower bud formation greater.

Plot 3.—Sprayed—1 per cent Carbide-Bordeaux, two sprayings March and June; foliage appeared healthier and denser than in Plot 1, but not so good as in Plot 2; flower bud formation no better, if as good, as in Plot 1.

Plot 4.—Sprayed—½ per cent Carbide-Bordeaux, one spraying in March; general appearance shows great improvement of Plot 1, but doubtful if as outstanding as Plot 2.

Plot 5.—Sprayed—½ per cent Carbide-Bordeaux, two sprayings March and June; foliage appeared as healthy and dense as in Plot 4, but flower bud formation was noticeably less.

Plot 6.—Sprayed—½ per cent Burgundy Mixture, one spraying in March : again noticeably better than Plot 1 but not so outstanding as Plots 2 and 4.

Plot 7.—Sprayed—½ per cent Burgundy Mixture, two sprayings March and June : this plot again showed an improvement as compared with Plot 1, but was not so outstanding as Plot 6, especially in flower bud formation.

The conclusions drawn from these observations show that spraying had a marked effect on the recovery of the trees after the drought. In addition to general appearance and health of the tree it must be noted that there was a definite increase in flower bud formation. It would, however, appear that the second spraying, at the period when the drought was most acute, had some detrimental effect on the tree, especially as regards flower bud formation.

The differences between 1 per cent and ½ per cent solutions of Carbide-Bordeaux and between Burgundy Mixture and Carbide-Bordeaux were as far as could be judged almost negligible.

The effect of different methods of application of manure on the distribution of roots and on the general behaviour of the tree.

This was commenced with the object of studying the general behaviour of the trees when subjected to different methods of application of manure and to conduct observations on the root systems of the trees grown under these several conditions. The area was divided into four plots of nine trees. One plot received a grass thatch, the others received equal applications of boma manure applied by (*a*) broadcasting, (*b*) trenching or furrows, (*c*) pitting. The effect of the thatching at the end of the year was most marked, flower bud formation and vegetative growth being outstanding. Of the remaining plots, that on which the manure was broadcasted appeared to have slightly more flower bud formation. The "trenching" and "pitting" plots were similar. These observations will be continued.

Study of the root growth and root systems of coffee trees.

A.—The technique employed for the study of root growth proved to be much more satisfactory than during the previous year. As a result the readings which were obtained and which were shown in the form of a graph (Fig. 1) are of especial interest. There appears to be no doubt that at this station surface root activity commences almost immediately after a heavy fall of rain and that it continues during the rains, gradually easing off as the dry weather sets in. It must be remembered that these reading were taken during a period of very low rainfall and consequently the duration of root activity was short. It will not be possible to formulate accurate data on this subject until readings have been taken over a period of years in which climatic conditions have been variable. On the same graph (Fig. 1) will be seen the curve representing shoot growth. The method employed in taking these measurements is open to criticism and therefore too much importance must not be attached to the results. However, it is interesting to record that these results are supported by investigations carried out by the soil chemist in other experiments. The measurements taken show that shoot growth was persistent and almost identical for all months during the year. This tree bore practically no crop during the year with the result that the natural suppression of shoot growth due to crop, which has been found most significant by the Soil Chemist, was not marked. The necessity for recording results for a period of years before useful data can be obtained applies in this case also.

B.—A number of root systems of trees have been washed out on this station and in other districts during the year. Interesting and useful information is being accumulated but it is as yet too early to commit the findings to paper as there are many factors which must first be considered.

C.—The damage done by raking away the leaf mulch or pruning under a tree on the surface feeding roots was clearly observed. The root systems of two trees growing side by side were washed out. The previous year, one of these trees had been under observation for the merits of Bordeaux spray. Consequently, the ground under the tree was raked monthly in order to record the incidence of leaf fall. The other tree had been left untouched with the result that there was a considerable amount of leaf mould and old prunings lying under it. When the two root systems were washed out the surface feeding roots on the tree subjected to observations the previous year were noticeably less than on the other. This again stresses the importance of careful hand weeding and cultivation on plantations; it is an all too common sight to see labourers pulling away the soil and mulch from under the drip of a tree leaving the surface feeding roots exposed.

Coffee varieties, tree selections and vegetative propagation.

Varieties.—The observations on a large number of varities continues. Amongst the most recent introduction there is little doubt that "Harar" promises to be outstanding in vigour and rate of growth. Sufficient is not yet known about the yielding capacity and liquoring quality to be able to say whether it will be a commercial proposition or not, but it most certainly promises well. Whilst a number of varieties are under observation as individuals, there are also many varieties being raised for use as rootstocks or scion material for grafting. At present the following species and varieties are being grown, some mature, some still in the nurseries :—

Coffea arabica.—Mocha, Kent's, Jackson's, Blue Mountain, Mysore, Kenya Selected, Harar, Guatamala, Columnaris, Padang, Bourbon, Maragogipe, San Ramon.

Coffea robusta.—Kinava, No. 9, Enaha, 124-01.

Coffea liberica and variety Dybowski.

Coffea stenophylla.

Coffea canephora.

Coffea excelsa.

Coffea congensis (hybrid).

Coffea Quillou.

Coffea eugenioides (wild Nandi coffee).

Coffea sp. (wild Iringa coffee).

Tree selections.—The possibility of finding outstanding hybrids on our own plantations is still being pursued. There has been an increase in the number of individual trees which have been selected and the seed from each of these is being propagated in our nurseries. Amongst these individual selections are a number of trees which have been chosen for their probable value as rootstocks.

Vegetative propagation : propagation of cuttings.—Still the only successful method of striking cuttings has been by the method mentioned in the previous report—that of etiolating sucker growth while still attached to the parent stem. The root system of a rooted cutting, planted out in the field the previous year, was washed out so that observations could be made on the root formation. It was with much satisfaction that we found a system as good, if not better, than that of a seedling plant of the same age ; both vertical and lateral roots being exceptionally well developed. The belief that coffee propagated vegetatively only produced a poor root system of a surface feeding nature was proved to be false under our conditions.

Grafting.—With the success obtained with grafting in the previous year it was decided that work of a definite nature should be proceeded with immediately. The first problem which it was decided to investigate was the value of different rootstocks. To obtain this data, scion wood of one variety, namely Kenya Selected, is being grafted onto a number of different stocks. So far, the following grafted material has been established and there are waiting to be transplanted into the field :—

Kenya Selected on—

Columnaris rootstock, 25 plants.
Blue Mt rootstock, 25 plants.
Marogogipe rootstock, 25 plants.
Robusta rootstock, 25 plants.

Other varieties at present being propagated for use as rootstocks include Harar, *C. liberica*, *C. Dybowski*, *C. canephora*, *C. excelsa*, *C. congensis* hybrid, *C. Quillou*, *C. eugenioides*.

Whilst this work is being given priority, the possibility of other varieties being more suitable for scion material has not been overlooked and a number of individual grafts are under observation.

Cover crops, green manures and mulching.

Cover crops.—A number of new possible cover crops are under observations but it is not intended to do more than mention their names as due to the excessively dry conditions which have prevailed throughout the year no data of any value have been collected. These crops are :—

(*a*) *Calopogonium orthocarpum.*
(*b*) *Centrosema plumieri.*
(*c*) *Cormilla varia.*
(*d*) Cossack lucerne.
(*e*) *Medicago sativa* L.
(*f*) *Crotalaria alata.*
(*g*) *Crotalaria invantulensis.*
(*h*) *Indigofera tettensis.*

Observations on other crops previously established are being continued, e.g. :—

(*a*) Black Mauritius bean.
(*b*) Mixed Lima bean.
(*c*) *Glycine javanica.*

Green manures.—There are no new crops worthy of special mention. *Njahi* and New Zealand Grass pea still appear to be very suited to our conditions during the March-April rains. Field peas and the mixture of Niger oil and field peas are preferable for use during the October rains. Whilst lupins are not very satisfactory here, they are undoubtedly of great value in certain areas.

Mulching.—Observations on mulched plots are being continued. Judging by the number of issues of Napier Grass (*Pennisetum purpureum*) made from this station during the past year, it is obvious that planters have fully appreciated its value as a crop for compost or mulch material.

Shade trees.—The following shade trees have been established at this station for observation and demonstration purposes :—

1. *Gliricidia maculata.*
2. *Millettia oblata.*
3. *Dalbergia assamica.*
4. *Grevillea robusta.*
5. *Ficus* sp.
6. *Cordia Holstii.*
7. *Machaerium tipu.*
8. *Acrocarpus fraxinifolius.*
9. *Albizzia lopantha.*
10. *Maesopsis birchemoides.*
11. *Commiphora* sp. Mukunguku (Kik.).
12. *Vernonia senegalensis*, Mororowet (Nandi).

A. D. TRENCH,
Senior Coffee Officer.

GRADING, CONDITIONING AND COOL STORE SERVICES

REPORT OF THE CHIEF GRADER AND INSPECTOR

PLANT IMPORT INSPECTION.

The following table gives the number of packages and values of the various importations into the Colony of seeds, fruit, plants, etc., in 1931, 1932 and 1933 :—

	No. of Packages			Declared Value		
	1931	1932	1933	1931	1932	1933
				Sh. cts.	*Sh. cts.*	*Sh. cts.*
Seeds ..	1,034	1,274	705	45,856 15	54,167 29	50,855 83
Fruit ..	16,272	9,327	12,913	143,474 94	86,786 58	105,344 51
Plants ..	271	227	184	9,759 64	8,457 42	6,853 22
Fruit trees	157	138	165	15,638 69	17,006 15	17,651 47
Tea seed	836	491	—	122,450 50	70,430 16	—
Bulbs ..	172	296	205	3,463 88	4,045 00	5,827 39
	18,742	11,753	14,172	340,643 80	240,892 60	186,532 42

It is of interest to note that whilst there was an increase of 2,419 in the number of packages inspected in 1933 as compared with 1932, there was a marked falling off in declared value.

In addition, 102 packages valued at Sh. 2,986/21 and five packages valued at Sh. 452/72 were passed in transit to Uganda and Tanganyika Territory respectively.

GRADING AND CONDITIONING SERVICES.

The Agricultural Produce Export (Potato) Rules, 1932, were amended by the promulgation of The Agricultural Produce Export (Potato) (Amendment) Rules, 1933, with effect from the 1st January, 1933.

The amendments aimed at giving a greater measure of control over the quality of potatoes submitted for export.

Maize Grading.

Maize from the 1932-33 season's crop was received at the Coast before the end of 1932. 103,966 bags had been presented direct for grading and 38,625 bags received consigned direct to the Conditioning Plant.

The reason for this early movement was commented upon in my annual report for 1932 and was directly attributed to the allocation of a monthly tonnage quota by the Kenya and Uganda Railways and Harbours for carrying export maize.

(*a*) *Maize presented direct for grading at the Coast.*

The total number of bags submitted direct for grading was 458,775. The following table shows the grades and relative percentages :—

GRADE	Number of Bags	Percentage of Total Received
		Per cent
K.2	232,746	50·73
K.2.SW	42,737	9·3
K.3	87,081	19·0
K.3.SW	32,227	7·02
K.7	297	0·06
K.8.W	11,393	2·5
K.8.W.SW	5,363	1·17
K.8.N.SW	130	0·03
Total Graded ..	411,974	89·8
Rejected—		
Wet	40,815	8·9
Weevily	1,195	0·26
Musty	904	0·19
Other Causes ..	3,887	0·85
Total Rejected ..	46,801	10·2
TOTAL RECEIVED ..	458,775	100·0

The total of 458,775 bags submitted direct for grading is an increase of 58.47 per cent on the previous year's total of 289,503 bags. The gross total of maize submitted direct for grading from the 1932-33 season's crop was 662,741 bags.

The percentage of maize graded K2 shows a decrease of 2.80 per cent on the previous year's percentage of 53.53 per cent, and a decrease of 18 per cent on the figures for 1931.

K3 maize shows a large percentage increase over the previous year, rising from 10.56 per cent to 19 per cent. Maize graded K3 has shown a progressive increase since 1930.

Wet maize shows the same percentage as for the previous year, namely 8.9 per cent.

Rejections for weevily, musty and other causes were considerably below normal, although weevily maize was in evidence throughout the season.

The following table shows the average moisture content of the rejected wet maize (statutory maximum, 12½ per cent) and the principal sending stations :—

STATION	Number of Bags	Average Moisture Content
		Per cent
Kitale	3,072	13·8
Eldoret	346	15·0
Ol Punyata	275	13·3
Lugari..	511	14·1
Hoey's Bridge ..	1,105	14·0
Kampi ya Moto ..	3,197	14·0
Rongai	4,757	15·2
Fort Ternan	440	13·7
Leseru	140	13·6
Mile 33½	302	13·8
Mile 30½	310	13·6
Mile 26½	250	14·8
Menengai	1,040	13·7
Sabatia	2,855	14·9
Njoro	1,145	14·3
Nakuru	155	13·6
Lumbwa	154	15·0
Wet by Rain.. ..	20,319	—

NOTE.—Stations forwarding less than 50 bags of wet maize are not included.

(*b*) Maize graded at the Conditioning Plant.

65,839 bags of maize were graded at the Conditioning Plant after treatment, being an increase of 23.18 per cent on the previous year's total of 53,449 bags.

The following table shows quantities, grades and relative percentages :—

GRADE	Number of Bags	Percentage of Total
		Per cent
K.2	31,474	47·8
K.2.C	340	0·51
K.3	31,774	48·26
K.3.C	2,230	3·38
K.8.FW	21	0·03
Total Graded ..	65,839	100·0
TOTAL RECEIVED	65,839	100·0

The percentage graded K2 after enjoying the advantages of conditioning, namely, 48 per cent, is very significant and emphasises the falling off in the quality of maize received for export.

(*c*) *Maize re-graded.*

7,198 bags of maize were re-graded, consisting of 2,876 bags which had been rejected for underweight and second-hand bags, and 4,332 bags which were reduced in grade from blockstacks. The following table shows the quantities and grades :—

GRADE	Number of Bags
K.2	1,549
K.2.SW	85
K.3	1,027
K.3.SW	78
K.8.SW	67
Total Graded ..	2,806
Wet	2
Weevily	4,388
Other Causes.. ..	2
Total Rejected ..	4,392
TOTAL RECEIVED	7,198

The gross number of bags graded, 531,812 (total of tables (*a*), (*b*) and (*c*)), is an increase of 53.5 per cent on the previous year's total of 346,429 bags.

1,011 bags were re-bagged and 40 bags re-sewn.

Shipments.

103 export certificates for 527,135 bags were issued as shown in the following table :—

Certificates	No. of Bags	Description
30	162,518	(K.2) Second Grade.
19	144,679	(K.2) Second Grade. Shipped in bulk.
11	46,058	(K.2.SW) Second Grade. Slightly weevily.
1	1,760	(K.2.SW) Second Grade. Slightly weevily, shipped in bulk.
1	340	(K.2.C) Second Grade. Treated by heat for the destruction of weevils.
21	90,957	(K.3.) Third Grade.
8	48,645	(K.3.) Third Grade. Shipped in bulk.
8	27,494	(K.3.SW) Third Grade. Slightly weevily.
2	2,230	(K.3.C) Third Grade. Treated by heat for the destruction of weevils.
1	1,693	(K.3.SW) Third Grade. Shipped in bulk.
1	761	(K.8.W) Under-grade White.

Rule 25.—Local Shipments.

114,971 bags of maize were shipped without export certificates being issued, and in many cases without examination, to ports north of Beira, south of Port Said and the coast of Arabia.

The total is an increase of 291.5 per cent on the previous year's figure of 29,362 bags.

In view of this large increase it is thought of interest to quote the actual ports as follows :—

	Bags
Tanga	8,782
Zanzibar	1,914
Dar es Salaam ..	18,022
Merca	11,450
Chisimaio	9,478
Mogadiscio	50,244
Brawa	5,903
Sokotra	6,011
Ahdhala	1,147
Benadara	1,520
Italla	224
Seychelles	276

Maize—General.

The conditions obtaining during harvesting operations for the 1932-33 season's crop were commented upon in my annual report for 1932. The remarks made at that time with regard to the quality of the maize submitted for export apply equally to the whole of the grading season.

The question of maize wet by rain in transport has been taken up with the Railway Administration.

The wider question of the deterioration of Kenya white maize has been very fully ventilated during the year and has been brought to the notice of all concerned, including the Board of Agriculture. Advantage was also taken of the occasion of the general meeting of the Kenya Farmers' Association, held at Kitale on the 7th November, to address the members on the subject of "Maize Grading at the Coast", and the subject of deterioration in the quality of export maize was especially stressed.

Conditioning Plant, Kilindini.

Maize.

A total of 67,278 bags of maize was treated, consisting of 64,639 bags wet, and 2,639 bags weevily.

63,557 bags were charged at a rate of 45 cents per bag, and 3,721 bags accepted consigned direct and charged at 35 cents per bag.

Beans.

A consignment of 80 bags of Rose Coco beans was treated experimentally in the smaller unit for the destruction of bean beetle (Bruchus). The treatment proved highly satisfactory. Germination tests revealed that the germination had been improved by the treatment.

General.

Double shifts of twelve hours each were worked throughout January and occasional normal shifts continued into May.

The annual overhaul was carried out during the slack months.

Grading of Potatoes.

43,679 cwt. of potatoes were submitted for grading and were classified as under :—

GRADE	Weight	Percentage of Total
	Cwt.	*Per cent*
K.1	16,346	37·42
K.2	25,642	58·71
Seed	287	0·65
Rejected	1,404	3·21

The total of 43,679 cwt. submitted for grading is a decrease of 28.9 per cent on the previous year's total of 61,462 cwt., but is an increase of 915 cwt. on the total for 1931.

The percentage of first grade potatoes shows a decline of 8.41 per cent as compared with the previous year.

Drought conditions which obtained in the Highlands of the Colony during the early part of the year, and a falling off in the acreage planted by non-native growers owing to the poor prices obtained during 1932, were probably the main causes for the decline in both quantity and quality.

Rejections on account of damaged tubers were below normal but early consignments were undersized. Many consignments of potatoes showed damage by Potato Moth.

Ship's Stores.

284 export entries in respect of 3,553 bags of potatoes, estimated at 5,710 cwt., were passed, being an increase of 44 cwt. over the previous year's total.

Grading of Beans.

(*a*) *Presented direct for grading.*

The following table shows the quantities, varieties and grades of beans presented direct for grading :—

VARIETY	K.1	K.1. SW	K.2	Total Grd.	Wet	Total Rejtd.	Total Recd.
Rose Coco	—	—	80	80	—	—	80
Madagascar Butter Beans	950	—	—	950	—	—	950
Broad Beans	1	—	—	1	—	—	1
White Runner ..	—	191	—	191	110	110	301
	951	191	80	1,222	110	110	1,332

(*b*) *Re-graded after sun-drying.*

VARIETY	Grade	No. of Bags
White Runner ..	K.1.SW	107

The actual number of bags graded, totals of (*a*) and (*b*), was 1,439 bags, as compared with 5,708 bags in 1932.

With the exception of the consignment of 80 bags of Rose Coco, the standard of quality was high.

Cool Stores.

New Regulations, Government Notice No. 195, were promulgated with effect as from 1st April, 1933.

The principal alteration in the regulations aimed at allowing goods to be charged on stored weight as opposed to withdrawn weight. To facilitate this, it was considered advisable to make a change over in the unit of charge. Originally, charges were based on the cwt. or part thereof. The present unit of weight and charge is the pound. Opportunity was also taken to give assistance in a slight degree to local producers of beef, mutton and veal, as also the newly established local fishing industry.

The following is a comparative statement of the quantities of commodities deposited in the Cool Stores since the inception of the service :—

COMMODITY	Unit	1933	1932	1931	1930	1929	1928	1927
Fruit	Lb.	126,690	103,145	181,793	193,547	155,180	128,399	102,229
Fresh Fish ..	,,	86,021	100,441	59,541	40,607	31,857	14,196	8,583
Cured Fish ..	,,	41,407	36,560	48,549	78,171	64,990	50,230	15,178
Cheese	,,	9,595	9,752	18,325	21,200	4,037	949	3,541
Offal	,,	2,749	2,760	3,130	4,449	5,528	794	472
Poultry	Dozen	$64\frac{2}{3}$	$8\frac{2}{3}$	$27\frac{1}{2}$	$34\frac{5}{6}$	$48\frac{2}{3}$	$10\frac{1}{2}$	12
Butter	Cases	1,803	5,213	5,098	9,401	2,305	2,484 479 lb.	1,544
Beef	Quarters Lb.	*35,250	292	$363\frac{1}{2}$	$324\frac{1}{2}$	301	212	211
Mutton and Pork	Carcasses Lb.	†18,692	$247\frac{1}{2}$	$276\frac{1}{2}$	$325\frac{1}{2}$	212	143	80
Eggs	Dozen	6,720	4,318	210	807	270	109	—
Ham and Bacon	Lb.	905	871	4,970	19,481	692	266	—
Vegetables ..	,,	4,525	634	312	140	3,702	8,161	3,979
Yeast	,,	1,924	1,611	234	125	30	—	—
Miscellaneous ..	..	vaccines sera rabbits milk	plants, game, milk, trout	sera, cake, chocolate, plants	milk	milk beer	8	—

NOTE.—*Quarter of beef averages 120 lb.
†Carcass of mutton averages 40 lb.

An examination of the table reveals that the backward tendency noted in 1932 has been arrested, with one notable exception, butter, deposits of which declined by 3,410 cases. Butter intended for export to European markets is being railed direct to the ship. This action has been made possible by an increase in the number of ships reserving insulated space for butter, and the number of insulated vans in use by the Kenya and Uganda Railways and Harbours. It would appear that our most fruitful source of revenue is fast disappearing, as only one consignment of butter intended for export to Europe was deposited in the Cool Stores pending shipment during the year.

Both machinery units were used alternatively during the year and gave very satisfactory service. There were no stoppages reported due to power fluctuations.

Visitors.

There was no diminution in the number of visitors during the year and continued interest is being shown in the Conditioning units, the Cool Stores and the Coffee Curing Works at Kilindini.

Acknowledgment.

The thanks of the department are tendered to the Port Manager and his staff for their continued co-operation and assistance.

C. L. SILVESTER,
Chief Grader and Inspector.

BALANCE SHEET—GRADING ACCOUNT

1st JANUARY, 1933 to 31st DECEMBER, 1933

Expenditure	Sh.	cts.	Revenue	Sh.	cts.
Salaries—			Maize—		
Graders and Inspectors	19,290	00	465,973 bags at 5 cents	23,298	65
Clerk	2,616	00	65,839 ,, at 1 cent	658	39
Labour	1,316	69	Potatoes—43,679 cwt. at 20 cents	8,735	80
Sundry Expenses	1,800	30	Beans—1,439 bags at 5 cents	71	95
Travelling	260	78	Moisture Tests—3 at 5/-	15	00
Passages (Proportionate)	1,819	17	Expenses of Fumigating one truck of beans	10	00
Office Rent (Proportionate)	239	59			
Housing (Proportionate)	1,788	00			
Medical Services (Estimated)	495	00			
Balance being Excess of Revenue over Expenditure	3,164	26			
Sh.	32,789	79	Sh.	32,789	79

BALANCE SHEET—CONDITIONING ACCOUNT 1st JANUARY, 1933 to 31st DECEMBER, 1933

EXPENDITURE	Sh.	cts.	REVENUE	Sh.	cts.
Salaries—			Maize—		
Graders and Inspectors	4,650	00			
Superintendent	5,770	00	63,557 bags at 45 cents	28,600	65
Mechanics (including Overtime)	3,642	96	3,721 bags at 35 cents	1,302	35
Clerk	1,635	00			
Labour	7,616	75	Beans—		
Sundry Expenses	5,771	14			
Rent of Siding	2,350	32	80 bags at 60 cents each	48	00
Travelling	638	52			
Passages (Proportionate)	1,023	56	Balance being Excess of Expenditure over Revenue	5,441	83
Office Rent (Proportionate)	239	58			
Housing (Proportionate)	1,650	00			
Medical Services (Estimated)	405	00			
Sh.	35,392	83	Sh.	35,392	83

NOTE

	£	s.	d.
Capital Cost of Conditioning Plant (1925)	10,743	15	3
Capital Cost of New Boiler (1929)	580	16	7
Capital Cost of Extension (1931)	2,402	0	0
£	13,726	11	10

No provision is made in this statement for interest charges. depreciation, or for Capital expenditure on new works.

BALANCE SHEET—COOL STORES
1ST JANUARY, 1933 TO 31ST DECEMBER, 1933.

EXPENDITURE	Sh.	cts.	REVENUE	Sh.	cts.
Salaries—			Receipts	17,786	56
Manager	4,650	00	To Balance being Excess of Expenditure over Revenue	25,806	63
Superintendent	5,770	00			
European Mechanic (Including Overtime, ..	8,329	59			
Asiatic Mechanic (Including Overtime)	3,478	66			
Clerk	1,635	00			
Electric Power and Water	11,723	85			
Ammonia	1,087	33			
Labour	772	00			
Sundries	1,061	07			
Office Rent	239	59			
Travelling Expenses	490	55			
Passages (Proportionate)	1,617	55			
Housing (Proportionate)	2,138	00			
Medical Services (Estimated)	600	00			
Sh.	43,593	19	Sh.	43,593	19

STATEMENT OF BALANCES AT 31ST DECEMBER, 1933

	Debit		Credit	
	Sh.	*cts.*	*Sh.*	*cts.*
GRADING ACCOUNT.				
1st November, 1923 to 31st October, 1924	..		5,732	78
1st November, 1924 to 30th June, 1925	..		9,138	86
st July, 1925 to 30th June, 1926 ..	3,056	13		
,, 1926 ,, ,, 1927 ..	..		31,423	50
,, 1927 ,, ,, 1928 ..	..		8,094	12
,, 1928 ,, ,, 1929 ..	..		27,553	51
,, 1929 ,, ,, 1930 ..	..		25,682	31
,, 1930 to 31st December, 1930	..		31,918	95
1st January, 1931 to 31st December, 1931	..		40,672	65
,, 1932 ,, ,, 1932	..		9,007	55
,, 1933 ,, ,, 1933	..		3,164	26
	3,056	13	192,388	49
CONDITIONING ACCOUNT				
1st July, 1925 to 30th June, 1926 ..	15,909	92		
,, 1926 ,, ,, 1927 ..	..		23,762	75
,, 1927 ,, ,, 1928 ..	9,397	31		
,, 1928 ,, ,, 1929 ..	..		5,634	84
,, 1929 ,, ,, 1930 ..	..		55,127	52
,, 1930 to 31st December, 1930..	..		68,973	04
1st January, 1931 to 31st December, 1931	..		2,381	86
,, 1932 ,, ,, 1932	11,285	70		
,, 1933 ,, ,, 1933	5,441	83		
Sh.	42,034	76	155,880	01

	Sh.	*cts.*
Grading credit balance at 31st December, 1933 ..	189,332	36
Conditioning credit balance at 31st December, 1933	113,845	25
Total credit balance, Grading and Conditioning, at 31st December, 1933 .. .. .. *Sh.*	303,177	61
Deduct Refund of four-fifths of Grading and Conditioning Charges made in Respect of 1929–30 Crop	301,423	83
Credit Balance at 31st December, 1933.. ..	1,753	78
£	87 13*s.*	9*d.*

Part III.—Animal Industry

REPORT OF THE DEPUTY DIRECTOR (Animal Industry) AND CHIEF VETERINARY OFFICER

This report, covering all branches of the Animal Industry Division is divided into the following sections :—

(*a*) Administrative and Executive.—General.
  (i) Settled Areas.
  (ii) Native Reserves.
(*b*) Veterinary Research.
(*c*) Experimental and Investigational Work at Government Farm, Naivasha (in collaboration with Rowett Research Institute, Aberdeen).

The Reports under (*b*) and (*c*) are given separately at the conclusion of the general Report.

(*a*) ADMINISTRATIVE AND EXECUTIVE.

GENERAL.

The rainfall during the year has been greatly below the average and semi-drought conditions have existed throughout the Colony. These drought conditions, following on a prolonged period of locust infestation, have caused stock farmers to investigate again the ways and means of altering their farming system to cope with these vagaries of nature, and in doing so they are steadily evolving farming systems best suited to the different areas in the Colony and the improvements in farming practice which were favourably reported on in 1932, have been continued this year.

A progressive improvement in the type of dairy stock is being maintained, which is an important indication that the stock industry, as such, is a sound proposition and the stock farmer is successfully grappling with his difficulties. The industry is still in the initial stages of development and successful progress must depend largely on the organizing ability gained through the changing experiences to be met from time to time in farming conditions. Such experiences and organizing ability should be centred on the control of the factors which underlie the various conditions and limitations of the different areas of the Colony, and stock farmers must give their careful consideration to the various means of improving their stock to suit the limitations of their particular areas. Experience is gradually but surely proving that this Colony is a stock country, in spite of the losses which accrue from disease. The problem of disease control has received the serious attention of the Veterinary Research Sub-Division and although the difficulties have been great solutions have been found that have created a confidence shared by all farmers, both stock and cereal, and this is reflected in the increasing activity of the stock industry. The useful investigational work of the Chief Veterinary Research Officer and his staff is produced in original in this report and justifies close study as it contains much valuable information. The experiments of ascertaining, by means of practical working and costings, animal husbandry methods under sub-tropical conditions have been continued throughout the year at the Government Farm, Naivasha. In addition to normal problems of disease the necessity of improving pastures and feeding practices has to be faced, along with the known mineral deficiencies. A lack of appreciation of these factors has resulted in the breeding up of live stock of a degenerate type with stunted development, loss of fertility and small production, but neither the difficulties nor the problems are peculiar to this Colony; they are found in all newly developing areas and are shared by the established stock countries in the older continents. The grade herds in the Colony have been bred up from the indigenous heifer, which possesses milk potentialities; but if greater use is to be made in the future of the native type as a foundation stock, then it must be improved by selective breeding and subjection to good herd management. That the native Zebu is responsive to such good animal husbandry has been amply demonstrated at the Native Training Centres in the Colony. It is realized that the selection work on native cattle in progress in the native training centres is dependent upon advances in the native methods of management of cattle and upon the production of an improved food supply, if the high yielding types produced are to survive in the hands of the natives and result in a permanent improvement of the live stock in the reserves. Consequently, efforts have been made to utilize certain of the native training centres for experimental work connected with grassland improvement and fodder production.

This work takes the form of experiments to determine the effects upon the main types of natural pasture of different intensities of grazing at Kabete, Ngong and Machakos, and trials as to the suitability of a number of fodder crops to the different climatic conditions in which the various centres are situated. In addition to this work, the most promising pasture plants are under trial at a number of the centres, as an extension of the work being conducted at a central grassland experimental station.

More serious attention should be given by farmers at this stage of development of the Colony to cow-testing. In these days of limited production a large percentage of poor cows eats up the profits produced by the good cows. In this respect the Milk Recording Scheme framed by the Stud Book Committee of the Royal Agricultural and Horticultural Society is commended for general attention.

Dairying Industry.—The year 1933 proved a difficult one as drought conditions prevailed in the pastoral areas, and following on the locust infestations of the previous year, they taxed fully the resources of the dairy farmers. While production of butter fell below that of the previous year, it still remained higher than the 1931 figure, so it may be recorded that ground has not been lost, and given good pastoral conditions a full recovery can be expected in 1934.

Butter fat prices fell to an average monthly figure of 73 cents per pound, and this, coupled with smaller production, increased the difficulties of the stock farmer. It is hoped that efforts to maintain and improve the quality of the cream supplies will not be relaxed as Kenya butter has a good name on the London market and when markets are flooded it is only the highest quality article that finds a steady sale.

Work was commenced on the new creamery at Thomson's Falls and preliminary investigations were made in regard to a factory at Eldoret to cope with supplies of cream from the Nzoia Province and contiguous native reserves.

Butter Levy Ordinance.—The financial assistance rendered to the export butter trade in 1933 amounted to Sh. 131,571/32, or 20.655 cents per pound on 705,047 lb. of butter exported, as compared with 17 cents per pound on 897,382 lb. of butter exported in 1932. The bounty of 20.655 cents per pound enabled the creameries to pay out an average figure of 73 cents per pound for butter fat; the heavy fall in export prices towards the end of the year being responsible for this low payout. Without the bounty, the butter fat producers would have received only 58 cents per pound of butter fat and many would have been in serious straits, and the development of the dairy industry severely checked.

During the difficult conditions of the past two years, the levy on local sales proved of material assistance to the dairy industry.

Cheese.—As an export trade in cheese, on any large scale, has so far not materialized, cheesemakers have to content themselves with supplying the East African market and the ships' stores trade.

Slaughter Stock.—This is another market that does not lend itself to expansion. Owing to the pastoral conditions the supply of first quality stock was very irregular throughout the year.

Meat Consumption.—Interesting points are raised by the increased consumption of meat in Nairobi, particularly beef; from the average monthly figure for 1930 of 858, the consumption rose to 1,072 in 1933. As Nairobi has decreased in population, one can only assume that more natives are including meat in their diet or that they are eating a larger amount. It is understood that in the Kikuyu and Kavirondo Native Reserves more meat is being eaten by the natives and so proteins are being added to an over-balanced carbohydrate diet.

The Pig Industry continued to improve in methods of production and management, with the result that an increasing number of first class pigs found their way to the factories, and with the lack of an export trade pig traders are wisely building up a high quality East African trade.

The Sheep Industry.—The drought conditions which were so detrimental to cattle, favoured sheep and this fact coupled with a sharp rise in the price of wool eased the difficult situation of the previous years. The nutritional requirements of sheep, the use of better rams and the eradication of sheep scab are matters which would well repay greater attention by the flock owners.

Eggs.—The main feature of the year lies in the efforts made by the Kenya Poultry Club to consolidate and enlarge the sale of eggs.

Egg Marketing.—In the year 1931 the Kenya Poultry Club commenced an egg marketing scheme, the work being done voluntarily. The amount of work entailed increased to such an extent that the executive of the Poultry Club decided to make arrangements for the marketing to be carried out by some organized firm on a commission basis. At the request of the Club, the Kenya Farmers' Association (Co-op.) Limited, undertook this work, with effect from the 1st of January, 1933.

The deliveries by members from the 1st of January, 1933, to the 31st of December, 1933, have been as under :—

	dozen
1st January, 1933, to 30th June, 1933 ...	15,690
1st July, 1933, to 31st December, 1933 ...	20,983
	36,673

The marketing arrangements have run fairly smoothly, but the greatest difficulty experienced has been that of the irregularity of supplies. On many occasions the agency had the utmost difficulty in securing sufficient eggs to complete contracts and at other times the quantities delivered have been far in excess of the local demand. This necessitated a shipment of 3,030 dozen eggs to London, in November, 1933, and the price realized for this shipment was just under 40 cents per dozen. It must be remembered that the agency has marketed only the surplus eggs, members all over the Colony disposing of eggs at the best prices obtainable, sending the balance to the agency for disposal. The agency has regular contracts with steamship lines and with consumers in Uganda. It is hoped that difficulties in the organization of production and supply will be overcome for eggs, in common with other primary products, are low priced and an intensification of the methods employed on the farms is desirable if the result is to be economical.

The official census of poultry owned by farmers in 1930 was 44,844; in 1931, 49,083; in 1932, 62,729, and in 1933, 57,037 birds.

In 1932 the total number of poultry increased by 139.6 per cent over the 1930 figure and in 1933 there is a decrease of 8.9 per cent over the same figure.

Native Pastoral Development.—In justification of the policy advocated and initiated by the department a few years ago, native pastoral development is becoming apparent, as a result of the interest taken in educational measures as practised in the Native Trading Centres.

The development of native dairying, as taught by the Trading Centres, is receiving increased attention and negotiations are at present in hand to facilitate the co-operation between the European and native producers in supporting co-operative creameries. These activities will be mainly confined in the first instance to the Kavirondo Native Reserves, where great quantities of cream are being produced under the supervision of departmental officers. The native producer, in thus becoming a contributor to the overseas market, will benefit directly in his cash returns, and places the pastoral industry of the Colony on a different plane, which must reflect favourably in regard to the economic position. In this connection, as showing what an organized effort on the part of the Native Administration, departmental officers and the native producers in one location (Kano) of the Central Kavirondo Native Reserve, can achieve, cream to the weight of 25,721 lb. was sent to a co-operative factory during October-November-December, 1933. It has been estimated that North Kavirondo Native Reserve is capable of producing large quantities of cream, and for the year 1933, 44,794 lb. of cream were sold locally to a European individual butter maker alone, and the total production of milk offered for sale from January to October, amounted to 884,775 lb. The estimate for 1934 is 1,155,453 lb., which would probably give 115,545 lb. of cream. These figures do show that it is possible to produce dairy products for export purposes from the native reserves of the Colony, if organized production is undertaken. The Kavirondo, Lumbwa, Nandi, Ukamba, Masai, Coast and Rift Valley Reserves are all capable of similar production, but in most cases no attempt has been made to develop these rich areas. In addition, parts of the native reserves of the Central Province are very well-suited to dairying and are situated within reasonable distance of co-operative factories.

As an initial step towards dairying, the native has been encouraged to produce ghee, in accordance with the methods demonstrated at the various Native Training Centres. Quite a considerable increase in exports has been noticed in the last six years, although the main market is in the Colony. Most of the ghee is being produced in the Nyanza Province. This ghee is of good and almost uniform quality and finds a ready market among certain communities in the Colony.

Trial consignments have been forwarded to the Indian, Zanzibar and London markets. The London market is the only one from which any beneficial results can be expected for trade development and a report is still awaited on these consignments.

The ghee industry is a useful one in pastoral reserves far removed from co-operative factories and markets, and as the local price has lately risen, it is hoped that the natives will persevere with the better methods of production and maintain the improved standard to which the local market has so readily responded, as shown by the increase in prices.

In the hide and skin trade there has been quite a gratifying rise in price, for the most part due to the efforts that have been made during the past three or four years to encourage natives to produce shade-dried skins. A great amount of energy, money and time has been spent in spreading this propaganda of better preparation, and shade-drying centres or bandas have been established in most native reserves.

Mombasa hides, however, have not a very good name on the overseas markets, and it will take some considerable time to obtain consistency from the native producers. A big issue in the better preparation of hides is the problem of the branding of cattle, which in the majority of native reserves causes mutilation to the hide which reduces the value to such an extent that it is almost worthless. However, hides to the value of £132,101 were exported during 1933, which showed a considerable improvement on the figure for 1932, £87,067. The report on the hide experiment carried out during 1932 is reviewed elsewhere in this report.

A scheme has been devised for the reduction of surplus stock in the native reserves, which are over stocked and are therefore showing the effects of soil erosion and consequently poor grazing. The drought conditions prevailing during 1933 have also proved that the large herds kept by most pastoral natives have no value on the local market, nor any strength to resist such conditions. In order to improve on these deplorable conditions, it has been suggested that by-products plants should be erected in or near the main pastoral reserves, based on the experience gained in the by-products plant erected by the Municipality of Nairobi. This plant absorbed, during 1933, 177 head of native scrub stock, mainly from the Masai Reserve : bone meal, meat meal and blood meal, and various fertilisers have been produced and the following are the actual figures given by the administration of the plant.

Weight of Material	Blood Yield	Fat	Bone Meal	Production Blood-meal	Horn and Hoof
Lb.	*Gallons*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
41,812	385	629	8,157	755	264

Such fertilizers will have a ready market in the Colony, as up to date most of the fertilizers are imported from overseas and are consequently out of reach of the smaller farmer and the native agriculturalist.

It has been suggested that a plant erected south of Nairobi could be supplied by the pastoral reserves lying to the north-east and south-west by stock routes specially designed to feed this plant; and a plant erected in the Ravine District could be supplied by the reserves lying to the north-west in the same manner. Provided suitable stock routes can be demarcated for this movement, there should be no difficulty in putting this scheme into action, as cattle can with reasonable conditions travel unlimited distances on hoof, thus saving transport charges. Once this scheme is put in action, one of the greatest drawbacks to the development of the pastoral native reserves will have been overcome, and in due course it is hoped that the native owners will realize it pays to have good healthy cattle, even if the numbers are not as great as when they possessed scrub, lame, decrepit and blind animals in their vast herds, which gave rise to disease and the erosion of the soil, thus reducing some of the reserves, which had formerly been the richest grazing areas in the Colony, to semi-desert conditions.

The position with regard to native sheep is more satisfactory, as it is an established industry and requires little more attention. However, attempts at improving the standard of flocks are being made in the Northern Frontier and Masai Districts. Wool production is a question that cannot be dealt with at this period of development because of the lack of funds and the general unsuitability of the native wool-bearing sheep as it is to-day.

The poultry industry suffers from very few drawbacks as far as climate and feeding is concerned, since there are so many varieties of cultivated and uncultivated feeds which reduce the cost of production to a minimum and enable the native to compete on this important market. The development of this trade is still in its infancy and a great deal remains to be done in the various reserves. The Training Centres are for the most part equipped for breeding good types and act as distributing centres for pure bred stock to the reserves, and as models for the teaching of poultry husbandry. Tremendous numbers of eggs of good standard, which year by year improves as the result of the issues of pure bred stock from the Training Centres, are produced for the local market, and, given sufficient inducement, these numbers could be increased enormously.

To place native produce generally on the export market means long and patient preparation, with demonstration and propaganda, most of which is supplied by the Training Centre. In those areas where there is no veterinary personnel, the Administrative Officers do all in their power to foster these ideas, with the object of advancing the pastoral native towards prosperity through the means of his flocks and herds.

Trade Conditions during 1933 *as shown by the Kenya Trade Report for* 1933.

Butter.—The production of butter for the year shows a reduction of 18.7 per cent in the export over 1932, although a considerable advance on 1931 figure. The bulk of the export of 7,514 cwt. went to the United Kingdom. The trade in Tanganyika Territory increased from 5,279 cwt. in 1932 to 5,934 cwt. in 1933, a rise of 12.2 per cent. In addition a small trade was commenced in Portuguese East Africa. The ship's stores trade expanded slightly and progress has been made in the production and sale of tinned butter, which rose to 253 cwt., Tanganyika Territory taking 194 cwt.

Ghee.—The annual trade report of the Colony continues to reflect the peculiarities of the ghee trade. The exports of domestic ghee show a decided increase, 2,377 cwt. being exported to Tanganyika Territory, Zanzibar, Syria and Palestine. On the other hand, Kenya and Uganda imported 8,310 cwt. at a declared value of £18,244 or Sh. 14 per frasila of 36 lb. This heavy importation of low quality ghee continues to be the main disturbing factor in the local ghee trade.

Wool.—The dry conditions had less effect on wool production than on butter and a slight reduction of 199 centals is recorded. The total export of 9,330 centals was valued at £38,481.

Cheese.—The East African market and ship's stores maintained a small steady trade in cheese and it is not expected that any great extension in the export cheese trade is practicable at present world values.

Hides and Skins.—The trade in hides showed a substantial increase in quantity and returns over the previous year. The Kenya figures are :—

	1932		1933	
	Quantity	Value	Quantity	Value
		£		£
HIDES—				
Dry and dry-salted *cwts.*	53,506	87,067	91,733	132,101
SKINS—				
Sheep and Goat .. *No.*	524,329	16,167	960,610	20,496
Other Animals .. *No.*	5,814	13,890	7,417	6,725

The exports of edible animal products to neighbouring territories continues to maintain its position and with improved conditions in Tanganyika and Uganda further increases can be anticipated.

The ships' stores trade for 1933 was valued at £6,854; as confidence in quality and regularity of supplies is established, the development of this trade should steadily progress.

The pastoral industries in 1933 did not relax their efforts to counteract the influence of lower commodity prices and adverse climatic conditions and a quick response to any alleviation of those adverse factors is confidently expected. Stock owners showed a progressive spirit by importing pure bred live stock to the value of £2,817.

Finance.—The actual expenditure in 1932 amounted to £67,821, in comparison with the 1933 figure of £64,832, which shows a decrease of £2,989. Extraordinary expenditure amounting to £1,100 was spent on the Rabies Campaign.

The revenue earned by the Animal Industry Division for 1933 amounted to £13,059, out of the total revenue of £17,412 for the whole department. The Animal Industry Division revenue figure is made up as follows :—

	£
Inoculation and dipping fees ...	10,168
Sale of Sera and Vaccines	2,326
Sale of Farm Produce and Stock ...	535
Sale of Stores	30

The decrease of £7,245 on the previous year is due to fewer fees being collected for inoculations and, to a less degree, to the reduction in sales of sera and vaccines, as a result of the reduction of votes for the manufacture of these products, in addition to the scarcity of money among stock owners.

The Board of Agriculture.—The Animal Industry Advisory Standing Committee of the Board of Agriculture held meetings on three occasions during the year on 16th January, 11th August and 24th November, and the following subjects were considered : the establishment of a creamery at Thomson's Falls; the movement of cattle under dipping permits; the movement of sheep and the incidence of heartwater; export of frozen pork; marketing of live stock; the Quarantine Station, Nairobi; rinderpest policy; the development of the pastoral reserves; production of ghee and the improvement of hides and skins; the meat export trade; the partial application of the Cattle Cleansing Ordinance; the economic use of surplus native stock; the Butter Levy Ordinance; fees for laboratory products; co-operative marketing of dairy produce and the export of stock to Uganda.

Legislation.—The Rules of the Diseases of Animals Ordinance have been frequently amended during the past few years, and in consequence of the difficulty of keeping a complete set of rules in an up-to-date manner, the rules were re-drafted in a consolidated form during the year, which in due course will be published in pamphlet form. Amendments to the Rules were necessary to alter the schedule of fees in respect of the sale of laboratory products and quarantine fees.

Additional supplementary conditions were introduced governing the movement of cattle in, through and between East Coast fever areas, and areas free from East Coast fever, to enable cattle to be moved from a non-infected area through an infected area into a clean area, under certain definite conditions.

The Diseases of Animals (Poultry) Rules were framed and sanctioned for the protection of the poultry industry against the introduction by imported birds or eggs of certain prevalent contagious diseases, including Bacillary White Diarrhoea and certain poultry diseases were scheduled as notifiable under the Diseases of Animals Ordinance.

On the closing of the quarantine station for the handling of imported stock, amendments to the Rules were temporarily substituted to permit of stock proceeding to an approved place where the stock would remain under observation, etc., in accordance with orders prescribed by the Chief Veterinary Officer.

Certain Rules were amended which removed the power of the Chief Veterinary Officer to be the authority for awarding grazing fees in cases of trespass of stock, as it was agreed that the recovery of such fees should be made through the procedure of the courts.

Under the Suppression of Rabies Ordinance, orders were published under the appropriate section for providing for keeping dogs under control and for the seizure and detention and disposal of infected dogs, etc.

Quarantines.—The following particulars are furnished in respect of quarantines imposed and revoked during the year, in Settled Areas and Native Reserves, showing comparison with 1932.

Disease	*Imposed* 1932	1933	*Revoked* 1932	1933	*Remaining* 1932	1933
East Coast Fever :—						
Northern " Clean " area	46	53	25	28	74	94
Molo " Clean" area ..	12	6	13	10	13	9
Limuru " Clean " area..	..	..	..	2	3	1
Rinderpest	73	45	70	41	18	21
Trypanosomiasis	6	10	8	3	14	21
Rabies	3	4	..	2	6	9
Pleuro-pneumonia	2	6	2	10	12	10

Animal Disease.—The general disease position in the Colony is not satisfactory, in spite of every departmental effort. Serious attention must be given to a stronger control of the disease factor which is increasing in prevalence and incidence; again it is regretted that another annual report must state the outbreaks of disease in general are on the increase.

Diligent research work has not been applied in a practical form, in the absence of practical schemes, although much effort has been made to commend them for general application, since the present financial position stands as an obstacle in the way of desirable advancement. The general reduction of revenue since 1930 from £31,366 to £13,059 indicates a scarcity of money among stock owners for the payment of the necessary fees for laboratory products and inoculations. In consequence, the control of disease, particularly rinderpest, is a difficult and never-ending task, as outbreaks cannot be handled expeditiously by the use of inoculation in the absence of the payment of fees.

In the settled areas it will be noted from the general summary of outbreaks of disease for the past seven years (*see* page 261) that the reported number of outbreaks of rinderpest decreased from 61 in 1932 to 35 in 1933, and a decrease is also shown in the reported number of outbreaks of contagious abortion, ulcerative and epizootic lymphangitis. The reason for the continued decrease in the number of outbreaks of lymphangitis is that there is a decrease in the use of mules for transport in favour of motor transport, as most of the cases in the past were reported as affecting mules, and also because of the general improvement in the management of horses throughout the Colony, particularly in the way of providing permanent stabling. Although the number of reported outbreaks of contagious abortion is shown in the returns to be less, it is generally accepted that the incidence of the disease is increasing in cattle. Confirmation of outbreaks must be made with a test of blood samples sent to the Laboratory at Kabete. The fees which were charged for such a test have precluded stock farmers from sending in samples when outbreaks were suspected. Representations were made to Government and the fees have now been withdrawn within certain limits.

The rinderpest position during the year has been helped by the large scale inoculations carried out among squatter stock during the previous year. It is noted again that the prevalence of this disease is in proportion to the density of native squatter stock population.

The increased number of outbreaks of tick-borne disease continues, and the contributing cause, as explained elsewhere in the report, has been the necessary risk of moving cattle from their customary grazing to save them dying from starvation. The application of the Fencing and Dipping Ordinances in a modified form has again been considered by the Board of Agriculture and on such a scheme being considered by farmers' associations, they agreed that the farmers were no more able financially to meet the obligations which the partial application of the Ordinance would impose on them than was Government.

The increased number of outbreaks of blackquarter and anthrax may be considered to be due to closer grazing of stock and the increase of the incidence of trypanosomiasis due to grazing afield in tsetse fly infested areas in search of food.

Rinderpest.—During the year forty-one fresh outbreaks of rinderpest were recorded in the alienated areas of this Colony. These outbreaks were controlled by one or other of the following methods : the simultaneous method of immunisation serum and blood virus; spleen virus and serum and the vaccine alone. In the Masai Reserve eighteen outbreaks of rinderpest have been reported during the year, but no outbreak has been reported since October. The Loitokitok area has now been free from this disease since May, 1932. The cattle population of the whole Kajiado district (Magadi line) is now believed to be immune. In the other native reserves or native areas of the Colony, the position during 1933 was as follows :—

	Outbreaks recorded
Coast Province	6
Northern Frontier Province	5
Northern Kavirondo (Sangalo)	6
Kamasia Reserve	1
Machakos Native Reserve	18

Thus making a total of fifty-four outbreaks during the year in native reserves and native areas and a grand total of ninety-five outbreaks of rinderpest during the year recorded in the Colony.

A mobile rinderpest service unit, of one senior Stock Inspector with six trained inoculators served during the year, and assisted the District Veterinary Officer, Lumbwa, in the district inoculations until March; while the lorry was being overhauled the staff were employed until June helping the

Veterinary Officer in charge, North Kavirondo Reserve, and afterwards for the remainder of the year helped the District Veterinary Officer, Eldoret, in district inoculations. During the year the lorry attached to the rinderpest unit travelled 3,720 miles.

East Coast Fever.—During the year fifty-eight fresh outbreaks occurred in the clean areas, of which fifty-two were recorded in the northern clean area, five in the Molo and one in the Limuru clean area.

The drought conditions throughout the year have resulted in an increase in the number of outbreaks in the so-called "clean" areas of the Colony; in the Nanyuki-Rumuruti districts there were thirty fresh outbreaks recorded as compared with nineteen in 1932 and twelve in 1931. Owing to the drought large numbers of cattle had to be moved from their respective farms to find grazing elsewhere, to prevent mortality from starvation. In many cases dipping was suspended because of the poor condition of the stock and the want of a dipping tank on the owner's farm. Certain factors indicate that the recorded figure of the number of outbreaks may not be accurate in relation to the incidence of the disease. Dipping, as now practised, merely prevents the occurrence of major outbreaks of the disease. Many of the reported outbreaks have only come to light through the zealous endeavour on the part of the Department in obtaining smears of all suspected animals, resulting in greater accuracy and in bringing to light slight outbreaks which may never have been discovered otherwise. There is some difficulty in detecting the presence of Koch's blue bodies in some of the smears submitted for examination from infected and suspected cases. Without a regular system of dip-testing and dipping inspection, an improvement on the present indifferent and slow method of controlling each individual outbreak cannot be made. Some farmers are very conscientious in reporting sickness, but others prefer to rely solely upon dipping to check the disease, even on a highly infected farm, and are not helpful when it comes to recording suspected cases.

In other "clean" areas where the grazing conditions were more satisfactory, the position of East Coast fever can be said to be about the same as last year; this is not satisfactory, as new infection centres have been found attributable to the illicit movement of stock.

It is disappointing to record that there are still many farms in the stock districts without any dips and no boundary fencing, although it is recorded that there are 381 cattle dips in the Colony.

The existence of squatter cattle is gradually being reduced in these districts, but native cattle in forests adjoining the farms and in the native reserves are always a danger, especially when grazing becomes scarce and trespass is easy over unfenced boundaries of farms.

The application of the Dipping and Fencing Ordinances has been sympathetically considered in some districts during the year and the difficulties and disadvantages of endeavouring to effect measures which are to be legally enforced have been realized, and until this gap can be bridged between the conditions existing to-day and the application of the Dipping and Fencing Ordinances, a strong co-operative effort from farmers is called for in the attempt to eradicate disease where it exists and the strict control of movement to prevent the spread of infection. Credit is due to those farmers where, by careful dipping and hand-dressing, East Coast fever has been completely eradicated or become negligible through their perseverance and in spite of their boundaries being surrounded by farms in districts where the disease exists generally in almost enzootic force.

Forty-four fresh outbreaks of East Coast fever were reported in the endemic areas. This record is more of an accidental nature than a true picture of the disease position in these areas, but it is known that a very high mortality occurs in the native reserves in the endemic areas, where control measures such as dipping, etc., are not observed.

Contagious Bovine Pleuro-Pneumonia.—The incidence of this disease in the Colony remains satisfactory as far as the settled areas are concerned; three outbreaks only have been reported during the year, one in the Nairobi district, one in the Lumbwa district of the Nyanza Province and one in the Mombasa district of the Coast Province.

The position in the native reserves and native areas is not so satisfactory. Pleuro-pneumonia is widespread in the Northern Frontier Province, particularly in the Samburu and Marsabit districts. The disease is also prevalent in the Masai Reserve and several outbreaks have been reported. An attempt has been made to provide quarantine camps for infected herds but the severe drought reacted unfavourably on such control measures. Two outbreaks of this disease have been reported from the Nyanza Province, one in the Central Kavirondo Reserve and one on the borders of Central and South Kavirondo Reserves.

Outbreaks of pleuro-pneumonia are or have been controlled by quarantine of infected herds and by vaccination.

Rabies.—This disease has become a problem in the Colony on account of the peculiar behaviour of the disease and as in common with South Africa the disease is restricted to one family of carnivora in this Colony—the jackal. In consequence the problem is one that may cause anxiety should rabies spread to the larger carnivores which are preserved in large numbers and to the large dog-owning native tribes. The disease appears to be primarily one of the jackal in this Colony, and this animal is the main source of the disease and the origin of outbreaks of rabies.

The history of rabies infection in this Colony, according to certain native information, shows that the disease has been active in jackals and dogs for some forty years, although in comparison with other dates from other native sources, where certain agreement has been obtained, the first serious outbreak occurred on the eastern shores of Lake Victoria Nyanza during the years of the War and again during the period 1918-21. The natives of this part of the Colony can describe the course of the disease as affecting man.

Apparently the disease has been in existence in a semi-epidemic state until 1931 when the attention of the medical officer stationed in a reserve bordering on Lake Victoria Nyanza in the absence of veterinary staff was drawn to it and he finally diagnosed the disease in human cases.

Investigation in 1932 proved that rabies was widespread in this district among native-owned dogs and diagnosis was definitely made by the identification of Negri bodies from infected dogs.

During the year 1933 a further number of cases, including seven dogs, fourteen jackals and one bovine have been microscopically confirmed and a large number of cases returned negative for various reasons—specimens not suitable for examination, although the history pointed undoubtedly to rabies. In all these cases the dogs and the bovines were infected by rabid jackals. The extension of rabies during the year has been considerable in the areas contiguous to the original infected districts and the cause is attributed to infected jackals in all cases.

The extensive poisoning campaign was so rigorously pursued in the infected and "control" areas, and with such success that the quarantine restrictions were lifted from some of the originally infected areas.

Since the beginning of the present outbreak, commencing in August, 1931, forty-six positive cases of rabies have been confirmed by the Veterinary Research Laboratory up to the end of the year 1933, and a number of highly suspicious cases have also been reported. In the proclaimed areas 632,007 baits have been distributed and the known destruction of rabies carriers is: 29,040 dogs, 1,413 jackals, 1,602 hyaenas, and 1,446 other animals. It has been estimated that approximately 5 per cent of the baits have been effective but it is considered that a very much higher mortality has resulted than that recorded. Experiments in trapping have been carried out and so far have not proved successful. Reports also indicate that sixty-one natives have been bitten by rabid animals, and that fity-eight have received anti-rabic treatment. Also that two Europeans have been bitten by rabid animals and six have received treatment. The distribution of the confirmed cases of rabies is as follows:—

EUROPEAN AREAS		NATIVE RESERVES	
Uasin Gishu–Eldoret	7	South Kavirondo–Kisii ..	9
Kericho–Sotik	17	North Kavirondo–Kakamega	1
Lumbwa–Mau Summit–Songhor	11	Central Kavirondo–Kisumu ..	1
	35		11

These figures are distributed among the various carriers as follows:—

EUROPEAN AREAS	Dogs	Jackals	Bovine	Total
Eldoret	1	5	1	7
Mau Summit	1	1	—	2
Songhor	—	4	—	4
NATIVE RESERVES				
Kisii	7	—	2	9
Kakamega	1	—	—	1
Kisumu	1	—	—	1
Lumbwa (including small European Area)	3	2	—	5
Kericho (including small European Area)	3	3	—	6
Sotik (including small European Area)	4	7	—	11

Sterility.—Within recent years the increase in dairy farming and the greater control of rinderpest and other contagious diseases have emphasized the importance of bovine sterility in Kenya. While all types of cattle, native, grade and pure bred, are at present affected by various forms of sterility, it is not improbable that with improvement of cattle by crossing with imported breeds the general incidence of sterility will increase. In the past considerable emphasis has been placed on pathological conditions as the cause of sterility. The tendency now is to take a wider view of the problem and to include among the possible causes physiological, nutritional and genetic factors. Owing to the prevalence of nutritional deficiency in various parts of this country, nutritional factors are probably of more importance here than elsewhere. Such deficiencies may not be of a sufficiently acute nature to cause actual disease but they may, by their adverse effects, on the physiological functions of the sexual and related organs, be responsible for reduced fertility.

Up to the present at least two forms of sterility have been encountered. Firstly, there is an apparently contagious disease that has, so far, only been seen in European-owned herds. This disease is responsible for an absolutely sterile period during which a farmer may go six months or two years without getting a single calf. At the termination of this period the majority of the cows will hold to service by a fertile bull, but a varying percentage may show permanent lesions which prevent them becoming pregnant. Some of the bulls also may be permanently affected. So far, attempts to find the agent responsible for this condition have been unsuccesful, probably partly because owners are naturally unwilling to allow valuable bulls and cows to be slaughtered for examination before they are absolutely certain that they are permanently sterile, and partly because the condition is usually well advanced before the owner himself realizes that something is wrong. So far all the cases that have been killed have been in the later stages of the disease, and it is possible that the originating cause has then disappeared.

Another form of sterility which is probably of the insufficiency type is characterized by absence of heat and consequent failure to get cows in calf. Very often this takes the form of undue prolongation of the interval between calving and the first oestrus, with resulting abnormally long periods between calvings. Moreover it has been noticed under experimental conditions that oestrus may be very brief in native cattle and also that there is seasonal variation in its duration and intensity. It is obvious that extreme variations of this nature may materially interfere with fertility.

Temporary sterility is generally considered to be of more economic importance than permanent sterility and, as this type is more amenable to treatment, research on its various causes would be amply repaid.

More detailed research is necessary on the various factors that have already been implicated as causes of sterility and it is necessary to know the relative importance of these various factors under local conditions. Further, it is necessary that such factors be investigated and, in the case of nutritional factors, it is essential that information on the nature, distribution and extent of pasture deficiencies in the Colony be obtained. It is only by such a broad attack that the problem of sterility can be solved.

Observations by Mr. James Anderson, B.Sc., M.R.C.V.S., in the field, on the Oestrous Cycle in Zebu Cattle.—Seventy-four heat periods were observed in five animals over the period of one year from March, 1933, to February, 1934. Oestrus was found to be of very short duration; the average duration was 81 minutes and the longest period noted was 171 minutes.

Animal	Number of Heat Periods	Average Duration in Minutes
66	17	82
31	16	80
72	16	91
80	11	96
90	14	54

In several instances only a single service took place when an animal was on heat. This occurred in eleven cases, i.e. in 14.1 per cent of the total number of heat periods. From the following table it will be seen that only 12.2 per cent of the heat periods were of longer duration than 130 minutes.

Oestrous Periods of Various Durations	Number	Percentage
150 minutes and over..	5	6·8
130–149 minutes ..	4	5·4
100–129 minutes ..	22	29·7
70–99 minutes ..	13	17·6
40–69 minutes ..	16	21·6
10–39 minutes ..	14	18·9

An appreciable variation in the average monthly duration of oestrus was noted. Oestrus was longest in July (125 minutes), October (106 minutes), January (103 minutes), and February (107 minutes). Co-incident with the observations on the oestrous cycle in the experimental animals a record of the number of fertile services that occurred per month in the breeding herd was kept. It was found that in the majority of cases an increase in the duration of oestrus was associated with an increase in the number of services in the same month in the breeding herd.

In connection with this experiment pasture analyses were very kindly undertaken by Professor R. G. Linton. These analyses indicate that the pasture on which the experimental animals were grazed was of low nutritive value, being poor in protein, chlorine and phosphorus. To what extent the very brief duration of oestrus in these Zebu cattle, compared with that in cattle in Britain, is due to genetic differences or to environment cannot at present be stated, but it would seem probable that the latter may be at least partly responsible. Deails of sixty-two cycles are given in the following table. The absolute minimum and maximum lengths of the cycles were seventeen days and twenty-two hours, and twenty-four days and four hours respectively.

Animal	Average Length of Cycle in Hours	Average Length of Cycle in Days and Hours
66	459	19 days 3 hours
31	510	21 ,, 6 ,,
72	452	18 ,, 20 ,,
80	507	21 ,, 3 ,,
90	501	20 ,, 21 ,,
Average	485·8	20 days 6 hours

A seasonal variation also occurred in the length of the cycle. The longest cycles occurred in the months preceding those in which there was an increase in the duration of oestrus. As a rule, a month with a short cycle was a month when oestrus was long and vice versa. An explanation of this is possible if it is assumed that a strong oestrus-inducing stimulus acts not only by causing oestrus to be more marked and of longer duration but also by causing oestrus to appear earlier, thus reducing the length of the cycle.

Ticks in relation to tick-borne diseases in general.—An additional report on the general tick survey of the Colony has been completed by the Veterinary Entomologist and includes a recent survey of the Kenya Masai Reserve, which was undertaken during the year and this report will in due time be officially published in bulletin form. Areas where *R. appendiculatus* occurs, and those endemic to East Coast fever, are demarcated and illustrated; and the peculiar distribution of various species of ticks is fully discussed in the bulletin.

The practical value of detailed studies in the field lies in the fact that it is possible to mark out with efficiency those areas which are, or are liable to be, unsuitable for the development of stock or mixed farming unless cleansing operations are practised. The absence of cattle, or other reasons, may account for the lack of information on the disease itself, but the presence of the vecting ticks on game, on the vegetation and on the land, points to potential sources of tick-borne diseases. Animals, other than cattle, may not be susceptible to the disease, the tick may not harbour the causal organism, but both the carrier and the parasite create new sources of infection. In undeveloped areas such a tick-survey enables one to gauge the difficulties which may confront the prospective stock farmer.

Recent outbreaks of East Coast fever, more especially in Laikipia district, have presented many atypical cases of the disease. No doubt similar cases exist in native reserves. This may be the result of transmission by a species of tick other than *R. appendiculatus* and it would seem desirable to continue the studies of species in the field along with the incidence and nature of the disease.

A comparatively small area of the Colony has been dealt with : the variations in climatic conditions, environmental influences, systems of farming, necessitate still further enquiries in this field of work.

Trypanosomiasis.—Observations on the prevalence of trypanosomiasis of domestic stock, and studies on the nature of outbreaks, indicate that the disease is becoming more widely distributed, and a serious menace to grazing areas which once maintained large herds of stock, especially in the Masai Reserve, South Kavirondo and the coastal area are now uninhabited owing to losses from animal trypanosomiasis; while on alienated farms in the Subukia, Laikipia and Thika districts in particular, the disease and the measures for control, of necessity, impede the progress of agricultural pursuits.

The most important trypanosome of stock in Kenya is *T. congolense*; it is exceedingly virulent to cattle, and causes serious mortality in infected areas. *T. vivax* also is an important pathogenic trypanosome which is responsible for a more chronic disease in cattle, and the mortality is less heavy than in animals infected with *T. congolense*. More recently, it has been proved that *T. evansi* occurs in camels in the Northern Frontier Province and in the coastal districts. *T. brucei* is by no means rare; it is comparatively harmless to the larger domestic animals, but causes a serious condition in dogs.

Entomological investigations into the distribution of the various species of tsetse-flies show that large areas at one time considered to be suitable for stock are now infested with tsetses. In the Masai Reserve *G. swynnertoni* and *G. pallidipes* inhabit one of the finest pasture-lands of the Colony, and it is feared that this fly-zone may advance still further. *G. pallidipes*, the most widely spread vector of animal trypanosomiasis, infests many thousands of square miles in the Colony; it is abundant in the coastal areas, in Ukamba, Teita, Galla Native Reserves, Nyanza Province and the Turkana and Northern Frontier Districts; it occurs along the larger river courses such as the Tana, the Tsavo, the southern and northern Uaso Nyiro; along the Mara River and the Kerio River; and the belts on some of the smaller rivers adjoining European farms extend widely during and immediately after the rainy seasons resulting in infection and heavy mortality among grade and dairy cattle.

Experiments on the control of *G. pallidipes*, by bush-clearing, trapping, fencing and possibly cultivation, are to be commenced shortly in the Lambwe Valley, South Kavirondo Native Reserve. The success of control measures in other territories, notably in Tanganyika and Southern Rhodesia, indicates the desirability of the adoption of such measures in Kenya. Further delay can only result in the extension of permanent fly belts; increase in losses from trypanosomiasis, and heavier expenditure in controlling the disease and the fly.

SUMMARY.

Veterinary Research.

At the Research Laboratory at Kabete, a good deal of useful investigational work has been carried out in spite of shortage of staff.

Detail improvements have been effected in the methods of manufacture of rinderpest vaccine, and the comparative tests of vaccine prepared in 1/1,000 formalin and 1/100 formalin are of great interest.

Valuable information has been obtained on the duration of immunity after rinderpest vaccination. In particular, the tests which the Chief Veterinary Research Officer has been able to make upon animals treated by inactivated vaccine followed by partially inactivated vaccine in 1927 are most important, since it is from this method that the present vaccine plus virus method of immunization has been developed.

There is also in progress a series of tests upon animals treated with inactivated vaccine by the ordinary routine method.

In the work on Nairobi sheep disease, it has now been shown after an exhaustive series of tests, that *Amblyomma variegatum* can act as a vector. This is undoubtedly the explanation of the serious outbreaks that occurred in the Laikipia area in 1931 in the absence of *Rhipicephalus appendiculatus*.

The record of bluetongue virus occurring naturally in the blood of cattle is also of interest, and it is remarkable that the virus recovered in this way should prove so highly pathogenic for sheep.

Promising results are reported from the experiments with horse sickness virus in the brains of mice, and it is hoped that in time a suitably attenuated virus will be produced for the inoculation of horses.

An account is given of specimens received for rabies diagnosis, and the attempts to fix strains of East Coast African virus still continue.

In the group of bacteriological diseases important progress has been made in the investigation of the etiology of contagious bovine pleuro-pneumonia. In addition to the case of experimental reproduction of the disease recorded last year, other successful transmissions have been obtained by the use of the "embolus production" technique. Further experiments along these lines promise to throw considerable light upon the question of infectivity of old sequestra. The disease has also been transmitted for the first time by contact under experimental conditions, and the length of the latent period before infection, after removal from contact, is illuminating.

It is most essential that we should have all the information possible on the behaviour of the virus under these conditions, in order that sound veterinary police regulations may be framed. This work is being continued and an application has been made to the Colonial Development Fund for assistance.

Information is being gathered on the incidence of infection with contagious bovine abortion among the breeding herds of the Colony. It is hoped that when legislation becomes practicable our knowledge of the distribution and infection rate in cattle will prove valuable in suggesting what control measures should be adopted.

The causal organism of paratyphoid infection in calves in Kenya has been shown to be *Salmonella*, Dublin, the same organism that is responsible for a similar infection in Europe.

Under protozoan diseases further attempts to treat East Coast fever are recorded.

Attempts have also been made to establish a diagnostic test applicable to the diagnosis of Trypanosomiasis in cattle where the parasite is *Trypanosoma congolense*. So far, no success has been obtained.

Under diseases of poultry, reference is made to the studies that have been carried out on fowl typhoid and pullorum disease. It is hoped that the prompt diagnosis of the latter disease by the laboratory has enabled us to prevent spread from the outbreak in question.

The brief reference to botulism in ducks and geese is also of interest.

A brief reference is also made to the experimental work on sterility, which is still being carried on, so far with no success in the attempts that have been made to reproduce the condition in cows.

During the last three years, the distribution of tick-species and the incidence of tick-borne diseases, have been investigated by the Entomologist in areas covering over 22,058 square miles of the total land area of the Colony.

It has been shown that the tick vector of East Coast fever is more widely spread than was suspected previous to the commencement of field-surveys; and that even in "settled" areas it is possible in the absence of rigid control, for the tick to spread further and establish itself.

Hitherto, the division of the Colony into infected (East Coast fever) and non-infected areas, has been determined largely by the presence of the disease in an endemic form, or its absence. Large areas have been, and are frequently, devoid of stock and consequently the disease was not known to exist in those areas. The occurrence of *R. appendiculatus* on game and vermin, and in the land on vegetation indicates, in the absence of stock and the disease, potential sources of East Coast fever and Nairobi sheep disease.

An important discovery concerning tsetse flies is that made by the Entomologist in the Narok area of the Masai Reserve. *Glossina swynnertoni*, previously unknown in the Colony, inhabits a wide area of good pasture-land in Osero, and adjoining the Tanganyika Territory. This species exists along with *Gl. pallidipes* and, in some parts, with *Gl. fuscipleuris*. The last species was erroneously termed *G. fusca* in the last annual report.

The spreading of *Gl. swynnertoni* towards the Gori River, where *Gl. palapis* is recorded by the Entomologist, may lead to serious consequences to stock and humans, because *Gl. swynnertoni* is capable of transmitting trypanosomes to both stock and man.

The allocation of a portion of the grant made by the Colonial Development Fund to experimental work on the control of *Gl. pallidipes* in the Lambwe Valley, South Kavirondo, is most encouraging. In consultation with the Director of Medical Services detailed experiments have been planned, and it is expected that actual work on the Lambwe Valley area will shortly commence.

Experiments — Government Farm, Naivasha.—The Naivasha Station has been established as an experimental centre, in regard to live stock problems, with the object of ascertaining by means of practical experiment and costings the direction in which animal husbandry methods obtaining in the temperate countries such as the United Kingdom should be modified to suit sub-tropical conditions such as those of Kenya. The year 1933 proved to be the most difficult in the history of the station, as regards the carrying out of these objects.

In common with all purely pastoral farms the station experienced a decrease in revenue owing to the continued fall in the prices obtained for animal products, but the position was aggravated by the drought conditions which persisted throughout the entire year. The farm grazing at the beginning of the year was showing substantial damage, as the result of two years of locust infestations and throughout the year the rainfall was insufficient to enable the grass to make any permanent recovery. The annual rainfall was seven inches below normal, only 13.04 inches being recorded. Had the grass been in good heart, even this low rainfall would probably have proved sufficient to prevent positive malnutrition, but the combination of drought and locust damage accruing from the previous years caused a heavier death rate than normal; the total death rate for cows, weaners, calves and steers (mainly attributable to poverty) was 17.2 per cent. It is hoped that the rainfall in 1934 will be on a sufficiently generous scale as to permit of a complete recovery of the grazing.

A further complication of the year's working was the fact that the farm continued to be in quarantine for East Coast fever until 6th of August, so that use could not be made of the Lakeside shamba which lies across a main road until that date. During 1933 therefore the farm carried two liabilities not common to other pastoral farms and the effects of these considerably increased the difficulties of management in what was in many other respects a difficult year to all pastoralists.

Butter fat prices continued to decline and an average payout of 73 cents per lb. by the Kenya Co-operative Creamery resulted in an average receipt of 71.88 cents per lb. by the farm, as compared with 78 cents in 1932. Slaughter stock were difficult to sell and prices reached a new low level. Wool sales showed a distinct improvement over the previous year, net receipts of 50 and 64 cents per lb. being received as compared with 31 and 35 cents in 1932.

Milk Production.—Owing to the adverse conditions, only 66.8 per cent of the total possible cow days were used, assuming a lactation period of 250 days, an average yield obtained was only 180 gallons per cow.

Calves.—The methods of hand-rearing outlined in previous reports were continued but after the sixth month, skim milk was continued as available in order to supplement the lack of grazing. The rearing of calves in pairs on foster mothers was quite successful but owing to the adverse grazing conditions the liveweight increases were lower than those of the previous year. The rearing of grade bull calves for slaughter purposes was discontinued.

Sheep.—The exceptionally dry climatic conditions during the year suited the flocks and they maintained their condition.

The wool clip was heavier than in 1932 and owing to a sharp rise in the wool market gave a substantially better return. Following 1932 practice, the clip was divided into two approximately equal lots and consigned to England and France. The net receipt position was, however, similar to that of 1932, as the English consignment again realized less than the French; the figures being 50.02 cents and 64.1 cents per lb. respectively, as compared with 31.5 cents and 35.1 cents in 1932.

Experimental Work.—Milk.—Feeding of green forage in the early months of the year resulted in a daily increase of milk yield by one half-gallon per cow. Later, when maize silage and green lucerne were used as substitutes for part of the production ration, the milk yields only decreased 20.2 and 20.4 per cent as compared with a general herd decrease of 40 per cent.

Calves.—A test was carried out to compare cattle salt with Magadi soda as mineral licks. The calves showed a distinct dislike for the Magadi soda. As the grazing position was so very complicated all the year, steps could not be taken to ensure that the calves did not have access to certain earth licks on the farm, but it was noticeable that during the time when the calves were kept in small paddocks with no earth licks, the salt group made the best live weight gains.

Suckling Calves.—An average daily live weight gain of .77 lb. was obtained throughout the year. Up to the age of six months the average gain was .96 lb. per day and it was hoped to maintain this figure, but the poverty conditions towards the end of the year made this impossible. These calves received no supplementary feeding. This system of calf-rearing is very applicable to the majority of ranch dairy farms and is worthy of wider application.

Sheep.—A test to define whether it is an economical proposition to feed weaner lambs up to twelve months old—the period during which least progress is made as shown by the records of the rate of growth of young stock on the farm—showed that the advantage gained by feeding after weaning was not retained after twelve months of age, and that such feeding was not economical. Neither in quality or weight was there any appreciable difference in the fleece weights of the different groups.

A test to compare salt and Magadi soda was carried out over a period of nine months, and the figures show the Magadi soda compares very favourably with salt, although owing to the farm being rich in earth licks, from which it was impossible to keep the sheep away, the figures might be misleading as compared with those parts of the country where such earth licks do not occur.

As regards fleece weights and quality, no appreciable difference was noted.

At the close of a most difficult year the cash position was poorer by £123. A full report on the workings of the farm is published separately.

Hide Experiments.—The report on the hide experiment carried out during 1932 has been received from the Imperial Institute and makes recommendations on the various methods employed in this experiment.

One thousand hides were used in this experiment, proposed by the late Mr. Eustace Montgomery, for the purpose of ascertaining the conditions which give rise to the development of "Blister" and "Taint" in East African hides. The hides were dried in Kenya and tanned in England.

Five hundred hides were dried by various methods during the wet weather and five hundred during the dry season. In each of these two groups a series of hides was left for one hour after flaying before preparation and another for six hours. Another was cleaned and another was left with fat and flesh on it. Each of these four series was treated in five different ways :—

(*a*) Shade-dried in a grass banda by stretching hides on poles with the hump raised and the shanks, etc., stretched to cross poles and so allowing for the formation of an air cushion.

(*b*) Sun-dried : hides stretched to form an air cushion as in (*a*) without and cover.

(*c*) Sun-dried : stretched on a bed of dry grass about two inches thick—grass cushion.

(*d*) Sun-dried : stretched directly on the ground as usually practised.

(*e*) Sun-dried : stretched directly on ground but flesh side loosely covered with grass.

In all experiments the hides were stretched with flesh side upwards and were of similar weights and were obtained freshly flayed.

The report states that there is no evidence to show that the delay between flaying and stretching of the hide is productive of greater putrefaction, or that the cleaning of the hide by removing fat and flesh causes less taint and blister, especially in the use of an air-cushion; but it does stress the fact that greater care must be taken in cleaning the hides, to avoid gouging them, and that the production of an air-cushion, whether in the shade or sun, reduces the putrefactive damage to a negligible amount, as it is only when the hide is stretched too firmly and causes pressure on the drying pole that a slight taint on the line of the pole is noted.

Thus the method advocated would appear to be that of the air cushion, preferably shade-dried, but not necessarily, and the factors of cleaning, and the lapse of time between flaying and stretching are of little or no account. The other methods are proved to be conducive to the development of extensive putrefactive damage.

To prevent the expense involved in erecting shade-drying facilities in the country, it was suggested that a simpler method should be adopted, which permits a free exposure to air on both sides of the stretched hide and prevents the ground heat from striking through the hide, which commonly causes putrefactive damage.

The method proposed consists of the erection of horizontal poles, about five feet in height and in a line running east and west. The tail and hind shanks of the hide are tied with ropes to the pole while the head and fore shanks to pegs in the ground. The ropes may be fixed to the poles and pegs and used repeatedly. The pegs should be placed on the line of the shadow thrown by the poles at midday. It will be necessary to move the line of pegs to correspond with the shadow of the pole at intervals of perhaps a week.

It is realized that this is not proposed to supersede the shade-drying method, but merely to improve on the native method of pegging hides on the ground. The difficulties in bringing this method into use in the native reserves are (1) that it will lead to confusion in the native mind as to the relative advantages of this method and shade-drying; (2) the risk of destruction by vermin; (3) theft; (4) the additional supervision by departmental officers necessary in the correction of the position of the pegs; (5) that as the industry increases, less supervision will be necessary, therefore it will be better to have shade-drying centres or bandas which are protected from vermin and theft and are easily supervised.

The question of cleaning the hides is an important one, as hides can be severely damaged by a too vigorous use of the knife in removing the fat and flesh, and thus bringing the value of the hide down to half that of a sound hide, as superficial layers of the true hide are gouged out in this process. Branding of hides, especially in the native fashion, renders them almost worthless on the world's markets, and places Mombasa hides very low in the estimation of the overseas buyers. The value of a sound hide as compared with that of a blistered, tainted, badly branded and gouged hide is exactly double.

The proper flaying and shade-drying of sheep and goat skins is gradually being introduced in native reserves and the production is increasing annually, although the very low price offered for the skins does not induce the native to take any extra trouble with the preparation of them for the market.

(*a*) (i) SETTLED AREAS.

SUMMARY OF OUTBREAKS OF DISEASE IN SETTLED AREAS DURING THE PAST SEVEN YEARS

Disease	1927	1928	1929	1930	1931	1932	1933
Rinderpest	73	83	66	34	29	61	35
East Coast Fever	31	37	32	33	33	76	109
Pleuro-pneumonia	20	8	4	3	1	1	3
Blackquarter	22	18	13	93	104	54	56
Trypanosomiasis	11	6	9	12	10	8	12
Foot and Mouth Disease ..	22	7	7	44	20	21	20
Horse Sickness	8	18	11	20	19	11	12
Ulcerative Lymphangitis ..	42	27	23	8	3	9	5
Epizootic Lymphangitis ..	7	7	3	3	..	6	..
Contagious Bovine Abortion	1	9	5	8	29	16	13
Swine Fever	2	7	..	3	4	1	..
Anthrax	27	43	20	23	25	25	41
Rabies	..	..	..	..	1	23	22

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE IN THE UASIN GISHU AND TRANS NZOIA DISTRICTS DURING THE YEAR AND THE FOUR PREVIOUS YEARS

Disease	1929	1930	1931	1932	1933
Rinderpest	1	1	11	24	7
East Coast Fever	..	..	18	26	26
Anthrax	4	9	7	9	9
Blackquarter	9	64	59	42	38
Anaplasmosis	..	..	5	2	13
Piroplasmosis	..	..	2	3	..
Trypanosomiasis	6	1	..	1	..
Ulcerative Lymphangitis ..	7	1	6	..	1
Foot and Mouth Disease	1	5	10	7	2
Horse Sickness	..	..	6	1	..
Kikuyu Fowl Disease ..	..	..	27	11	3
Contagious Abortion ..	..	..	1	..	..
Pleuro-pneumonia ..	..	..	..	1	..
Cow Pox	..	..	..	..	2
Rabies	..	..	..	..	7

No serious outbreaks of disease occurred during the year with the exception of an outbreak of rabies in the Burnt Forest area of the Uasin Gishu which now appears to have died out. Following the 1932 compulsory rinderpest inoculations the position as regards this disease was good and only seven outbreaks are reported, all of course in squatter stock. Two outbreaks of cow pox were reported and confirmed and in both cases persons handling the stock had contracted the disease.

Squatter stock.—The system of squatter labour persists throughout the districts, and it is thought that there are at least 200,000 head of native-owned cattle on the farms in the two districts. There is little or no control over squatter stock diseases, with the exception of rinderpest they are seldom reported to the farm owner. A determined effort has been made by the District Officers in the Uasin Gishu and Trans Nzoia districts to reduce the numbers of squatter stock to reasonable limits.

In 1932 some 70,000 head of susceptible stock was dealt with which did not include the Farm 35-Kipkabus-Ainabkoi and Timboroa areas.

Six outbreaks of rinderpest were recorded among squatter-owned stock and these were dealt with by inoculation. The following numbers were inoculated during the year: Adults, 16,558; calves, 1,903. Tests, 100; mortality, 3½ per cent.

A number of farmers use rinderpest vaccine for their stock and some 284 doses were sold.

Rabies appeared in the Burnt Forest area in October and by the end of the year five positive cases were diagnosed: one in a dog, three in jackal and one in a bovine. Extensive poison baiting was carried out in the infected and surrounding areas and some 13,000 baits were issued by the department. A bounty of Sh. 1 was paid for jackal tails, but, with the exception of the natives in the Nandi Reserve, the response was poor, only sixty-one tails having been produced for payment. Farmers were instructed to shoot all dogs not under control on their property and all strays at railway stations, townships, etc., were destroyed. Several natives were admitted to hospital for treatment as the result of bites.

Anthrax.—Six outbreaks were reported and 1,405 doses vaccine sold.

Blackquarter.—Twenty-three outbreaks reported and 5,660 doses of vaccine sold.

These two diseases are now endemic in this district and the annual loss is high. The number of outbreaks reported in no way gives an idea of the number that actually occur. In some cases whole bomas of sheep and goats were wiped out with quite a few cattle and in practically every native boma where anthrax occurs one finds the owners affected with malignant pustule.

Foot and Mouth Disease.—One outbreak was reported but did not appear to be very virulent. One imported bull died some months after the outbreak from the sequelae of the disease. Very few farmers are aware of the existence of foot and mouth disease on their farms and therefore do not report it.

General.—Several farmers in the district are gradually changing over to mixed farming and during the year under review several dipping tanks have been built. Had times been more prosperous there is no doubt that the stock industry would have progressed more rapidly.

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE IN THE NANYUKI DISTRICT DURING THE YEAR AND THE FOUR PREVIOUS YEARS

The Nanyuki Veterinary District includes the Laikipia Administrative District.

Disease	1929	1930	1931	1932	1933
Rinderpest	4	10	6	..	..
East Coast Fever ..	17	10	12	16	30
Pleuro-pneumonia ..	2	1	2	..	1
Foot and Mouth Disease	..	36	5	..	7
Trypanosomiasis	1	1	..	2	..
Heartwater	..	..	1	..	4
Blackquarter	3	..	19	1	5
Horse Sickness	4	8	1	6	9
Anthrax	..	..	..	1	5

East Coast Fever.—The comparative figures of the last three years reveal a definite increase in the incidence of East Coast fever. The higher figure of the year under review has no doubt been influenced by drought conditions, as a result of which some 20,000 cattle had to leave their respective farms to find grazing elsewhere. In many cases dipping had to be suspended for want of dipping tanks. In others, stockowners elected to cease dipping because of the poor condition of their cattle. Consequently deaths were not only occurring from starvation but also from tick-borne diseases other than East Coast fever. Again, such movements resulted in cattle not being under constant European supervision. The mortality, and so the degree of infection, on a number of farms has been very high. Thus a variety of circumstances has favoured an increased incidence of the disease in a district already carrying a large number of infected areas, certain of which have been and some continue to be very heavily infected. Certain factors indicate that actual figures not only of cases but also of outbreaks may not bear a very accurate relation to the incidence of East Coast fever. The process of dipping as it is carried out at the present time is at least sufficient to prevent the occurrence of major outbreaks.

Foot and Mouth Disease.—Seven outbreaks have occurred during the year. They followed the usual course, none exhibiting marked severity such as has been reported from this district in past years. Presumably in consequence of the last-mentioned factor, stockowners have asked for stringent control measures, and it appears to have been the custom to endeavour to follow this course. Attention has been given to the subject of control in view of the importance with which it has been regarded in this district. The original proposal for very limited control only was considered the most practicable scheme and now has the support of the district.

Contagious Bovine Pleuro-Pneumonia.—The Dorobo country in the north of this district has been in provisional quarantine for this disease. Its actual existence was determined recently and the area is now a pleuro-pneumonia infected place. There is little doubt that it is an extension from the Samburu cattle. An outbreak of the disease has now occurred in the settled area. It is more than probable that an interchange of cattle between natives has occurred and is the cause of this outbreak.

Trypanosomiasis.—Two outbreaks were reported from Laikipia in the Ol Arabel Valley. Among the more common factors it is suggested that native cattle are in part responsible.

Rinderpest.—No outbreaks of this disease have occurred in the settled area. The presence of the disease in the Meru Native Reserve was confirmed during December. Vaccination was carried out on a large scale in the adjacent settled area. The susceptible cattle in this district have been increasing from year to year. While a few years ago, a high percentage of European-owned herds were immune, the number has become progressively smaller. Therefore, the subject of rinderpest immunization was brought before the several district associations and in many cases stockowners have taken steps to protect their cattle.

Contagious Abortion of Cattle and Sterility.—The incidence of contagious bovine abortion in this district is not known. It does not appear to be high from what data there are available. Granular vaginitis, associated with sterility, is widespread and a cause of much loss to breeding herds. Investigations on a number of herds have been made, limited by time and funds available.

Heartwater.—Five cases of this disease are recorded on the monthly returns of stock diseases. The whole district carries herds of native-owned sheep and goats. In spite of views to the contrary, the number of cases actually brought to our notice by the submission of material is extraordinarily small.

Redwater and Anaplasmosis.—These diseases are only of importance in their relation to dipping, especially in the eradication or control of East Coast fever. More and more herds are becoming susceptible to these diseases, and it is a conditions which stockowners must accept.

Anthrax.—Five cases of the disease are recorded prior to September; it is probable that they were of the usual sporadic nature.

Blackquarter.—The number of cases recorded is: Nanyuki five and Rumuruti seven.

Horse Sickness.—The number of cases recorded is: Nanyuki three and Rumuruti six. Trade Somali ponies coming into Nanyuki are frequently victims of the disease. More and more advantage is being taken of vaccination.

Summary.—The major problem in the district is East Coast fever. The proportion of fencing, especially boundary fencing, is small and this is most regrettable. A number of farms are still without dips.

The second most pressing problem is the opportunity for the introduction of pleuro-pneumonia and/or rinderpest from contiguous native areas. In the case of the latter stockowners have an effective means of protecting their stock and it is considered that more and more will adopt the principle of annual vaccination. The position with regard to pleuro-pneumonia is less satisfactory both as regards the detection of the disease and its control.

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE IN THE NAKURU DISTRICT DURING THE YEAR AND THE FOUR PREVIOUS YEARS

Disease	1929	1930	1931	1932	1933
Rinderpest	3	..	1	3	4
Pleuro-pneumonia	..	..	..	..	..
East Coast Fever	9	2	12	13	17
Trypanosomiasis	..	..	..	1	6
Blackquarter	1	6	17	2	12
Anthrax	5	1	15	8	20
Foot and Mouth Disease	4	..	6	4	8
Horse Sickness	..	2	1	1	2
Ulcerative Lymphangitis	..	..	1	5	..
Contagious Abortion	3	..	41	8	12
Avian Tuberculosis	..	..	1	..	..
Kikuyu Fowl Disease	..	..	4	2	1
Swine Fever	..	..	3	1	..

The Nakuru Veterinary District includes the Gilgil, Naivasha, Kijabe and Ravine Administrative Districts.

Rinderpest.—Of the four reported outbreaks of this disease, three were in settled areas and the remaining one in the Kamasia Native Reserve. The origin of the former cases is not known with certainty, but the latter one was an extension from the Elgeyo Native Reserve. The former cases were dealt with by the use of vaccine and the latter one by the double-inoculation mthod.

East Coast Fever.—In the "clean" areas of this district seventeen fresh outbreaks of East Coast fever were reported. It is difficult to state any particular cause for this large number of outbreaks but undoubtedly the movement of squatters' sheep and goats, the movement of game and the illegal occupation of vacant farm land by native stock form a very important group of factors. It is perhaps unnecessary to repeat that no real progress will be made in the control of this disease until dipping and fencing become universal.

Trypanosomiasis.—Of the six outbreaks, one was a dog in Nakuru township, which developed the disease about three weeks after returning from the Coast. It died after an apparent cure by the use of "Bayer 205". The other outbreaks were among cattle and resulted in a mortality of about twenty-four head. All were in or adjoining the Sabukia Valley, and in some cases may have been spread by game moving from Lake Baringo region to the forest country towards Rumuruti.

Blackquarter.—Twelve outbreaks were reported, all being dealt with by the owners by vaccination.

Anthrax.—This disease occurred in most instances in isolated cases, and only in one outbreak were the results remarkable. In this, however, the cattle were vaccinated three times within ten months before the disease was finally stopped, the mortality being about twenty-four cattle and one pig. All these occurred on one section of the farm concerned, and no doubt the disease assumed a specially virulent form. Where-ever any supply of milk or cream was concerned, the medical authorities were notified.

Foot and Mouth Disease.—All outbreaks occurred near Naivasha, and the form assumed by the disease was very mild, foot lesions being very rare. It was noticed at the same time that many of the game near Mt. Longonot were lame and ill, but unfortunately one was not in a position to shoot any of them and ascertain if the disease was foot and mouth. All owners of in-contact cattle were persuaded to take steps to ensure that the infection should spread as rapidly as possible through their herds in order to eliminate it as quickly as might be.

Contagious Abortion.—Twelve cases were diagnosed, but it is probable that this disease may be shown to be one of the commonest in the country. The disease was eliminated from some pure bred or very high-grade herds and will probably be achieved very shortly in several others.

Redwater.—Of the five outbreaks reported, only one was serious. In this case bullocks were moved on to land which had been occupied by squatters' sheep and goats for some years. The move was unavoidable, the alternative being severe losses from starvation. The results were unfortunate, some eighty-five head being lost out of about 250 before the outbreak was got under control by short interval dipping.

Horse Sickness.—Two cases of this disease were diagnosed. It is likely that the low figures are due to an exceptionally dry year and the fact that so many farms in the Nakuru-Naivasha district have now become to all intents and purposes derelict.

General.—On account of the serious state of affairs produced by drought, some 8,000 head of cattle were moved from the Nakuru-Naivasha district to various parts of the Laikipia district. A further 3,000 were moved to other parts for the same reason. It is to be feared that when in due course movement takes place in the reverse direction, there may be several outbreaks of disease directly traceable to such movement.

Following on the closing down of the Nairobi Quarantine Station, one imported bull was tested for tuberculosis, and three imported bulls put through vaccination against redwater and anaplasmosis.

A considerable amount of work was done in an attempt to persuade settlers that the presence of squatter-owned stock on their farms was dangerous from the point of animal disease. Some progress has been made, and such stock has been removed by unanimous agreement from the farms in one area without any noticeable effect on the labour supply. Arrangements are now being made to achieve a similar result in another area, and in this area—Sabukia—it will probably lead to the effective control of East Coast Fever.

In an endeavour to prevent the eastward spread of rabies, several forest reserves near Eldama Ravine were placed in provisional quarantine for that disease, thus enabling poison-baiting, etc., to be carried out without danger of compensation being incurred. In addition many settlers of the line Elburgon-Lower Molo have removed native dogs from their farms.

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE IN THE LUMBWA VETERINARY DISTRICT, DURING THE YEAR AND THE FOUR PREVIOUS YEAR

DISEASE	1929	1930	1931	1932	1933
Rinderpest	1	1	11	24	12
East Coast Fever	1	1	18	26	4
Anthrax	4	9	7	9	2
Blackquarter	9	64	59	42	..
Trypanosomasis	6	1	..	1	2
Ulcerative Lymphangitis	7	1	6	..	3
Foot and Mouth Disease	1	5	10	7	..
Horse Sickness	..	..	6	1	1
Kikuyu Fowl Disease	..	..	27	11	..
Contagious Abortion	..	..	1	..	1
Pleuro-pneumonia	..	..	..	1	1
Hæmorrhagic Septicæmia	..	..	..	..	1
Rabies	..	..	..	6	13

Rinderpest.—During the year twelve outbreaks of rinderpest were recorded, all of which occurred in the Kisumu-Londiani District and in every case, if not actually found in native-owned cattle, its origin was traced to their presence. Rinderpest is always present in the Lumbwa Native Reserve and should be looked upon as one permanent outbreak. The Sotik farms which act as a buffer between South Kavirondo and the Lumbwa Native Reserves have a large stock population, which is constantly being interchanged with the stock in the Lumbwa Reserve, with the result the position on these farms, as regards rinderpest and other diseases, is the same as in the Reserves.

The forests, which comprise a very large portion of the district also harbour native stock, and rinderpest existed in the Tinderet Forest for the latter part of the year. It is thought the drought was partly the cause of natives moving their cattle illicitly from elsewhere into the forest in the search for grazing and was thus responsible for the spread of the disease.

The annual double inoculations were begun so late in 1932 that they were not concluded until the beginning of 1933. They were, however, begun in the year under review at the usual time, namely in September, and finished with the Sotik farms in November.

Molo, Mau Summit and Londiani, where squatter cattle have been abolished, have adopted the inactivated vaccine method for immunization. In actual practice, scarcely any immunization of cattle took place, with the result a large susceptible cattle population is growing up in those areas. This tendency of not immunizing stock annually with the rinderpest vaccine, however, is not confined to this district.

Two dipped farms, near Lumbwa, last year adopted for the first time the vaccine-virus method for immunizing their cattle, and had their natural increase treated in the same way this year. The procedure is as follows: weaners, i.e. cattle over a year old, are each inoculated with one dose of 15 c.c. of inactivated rinderpest vaccine, followed about fourteen days later with 2 c.c. each of spleen virus also supplied by the Veterinary Research Laboratory and despatched in ice chests. The reactions which resulted for the most part could scarcely be detected, although one animal contracted rinderpest and died, not more than half-a-dozen showed mild lesions and recovered, out of a total of 329 weaners so treated.

Unweaned calves, or animals under a year old, are not given the virus following the one dose of vaccine, which in their case is 10 c.c. instead of 15 c.c. and appears sufficient to protect them from contact infection and probably confers an immunity until they are old enough to be inoculated with the vaccine and virus the following year.

With the exception of the one animal which died of rinderpest, the reason for which is not understood, as there is no doubt that it received the full dose of vaccine before the virus, and the few animals which showed rinderpest to a mild degree, scarcely any loss in condition could be detected, as a contrast to the simultaneous double inoculation method. The immunity conferred, although not life-long, as in the case of double inoculation, is expected to last for a considerable period, possibly five years.

A few other dipped farms employed the inactivated vaccine before the commencement of the rinderpest double inoculation campaign, and it is thought that in future more farms will adopt the vaccine-virus method, as the immunity conferred by the course of the inactivated vaccine requires reinforcing annually and becomes in the end more expensive.

The numbers of cattle double-inoculated during the year at the various centres are : adults, 8,264 ; calves, 4,080 ; tests, 52 ; mortality, 204. The revenue collected in respect of double-inoculations actually carried out on farm stock in 1933 was Sh. 24,652.

In spite of the annual inoculations held in this district, outbreaks of rinderpest are always liable to occur. The reluctance on the part of the owners to having all their susceptible cattle inoculated, together with the fact that illicit movement to and from the reserves is constantly taking place, is responsible for this state of affairs.

East Coast Fever.—This disease is enzootic in this district, with the exception of the Molo "clean" area. There are, however, now quite a number of farms in the "dirty" area where by careful dipping and hand-dressing, East Coast fever has been completely eradicated or has become a negligible factor.

In the Molo "clean" area, which includes Mau Summit, ten farms were in quarantine for East Coast fever at the beginning of the year, and at the end, six. Eight of the old quarantines were removed and four fresh quarantines imposed. Although there has been a decrease in the number of fresh outbreaks recorded, the position actually remains about the same. Two outbreaks were detected accidentally and there is no doubt other outbreaks have occurred which have not been diagnosed. It is a regrettable fact that every stock farm has not yet got a dipping tank, and fencing in this area is still for the most part absent. The fact that squatter cattle have already been abolished from the "clean" area, has very materially assisted in keeping down the disease, but the existence of native cattle in the forests adjoining the farms is always a danger, especially when grazing becomes scarce and they trespass over the unfenced boundaries of the farms. Until measures, such as compulsory dipping and fencing, with proper supervision, come about, outbreaks of East Coast fever are likely to occur, and it is due more to the natural conditions which obtain around Molo, than the efforts made by the farmers themselves that the disease has not had more serious consequences. It is a well-known fact that sporadic cases of East Coast fever can occur and without any proper measures being adopted to reduce tick life only odd cases occur subsequently. This, however, is not always the case, as has been the experience on certain farms where a heavy mortality has occurred from this disease. In these cases the disease had not been detected in the initial stages of the outbreak and therefore no action taken until it was well established.

Rabies.—The outbreak of rabies which was confirmed the previous year in the South Lumbwa, Kisumu-Londiani and Mau Summit districts continued at the beginning of the year to cause general anxiety, and it was not until towards the end of 1933 that the position in this district became easier. The campaign which was inaugurated in 1932 for the destruction of all uncontrolled dogs and carnivores was continued right through the year under review. The number of cases of rabies confirmed by the Veterinary Research Laboratory from specimens of brains obtained during the year fom animals in this district were : three dogs and ten jackals. To this total a considerable number should be added, as for various reasons specimens satisfactory for diagnosis were not available from suspicious animals. Moreover, jackals were the chief culprits in spreading rabies in this district, naturally the true incidence of the disease in that species could not be determined.

As no more cases were detected around Mau Summit since November, 1932, the whole of the Molo "clean" area was removed from quarantine after the forests and farms around Mau Summit had been baited and also the Western Mau, when the prescribed period from the last case had elapsed.

In July another case of rabies occurred in a European-owned dog at Koru. In the last quarter of the year three cases in jackals occurred around Songhor, one European and two more natives were so closely associated with the cases that they had to receive medical treatment. Until the end of the year the distribution of poison bait was continued in this area. Thus, in the Kisumu-Londiani District during 1933, four cases existing in jackals and one in a dog were all confirmed by the Veterinary Research Laboratory. In South Lumbwa district no more cases were recorded in 1933 in the Belgut and Sotik Native Reserves, nor on the European farms and plantations around Kericho. The heavy baiting of the previous year together with the valuable assistance rendered by the public had almost completely wiped out uncontrolled dogs. In spite of the absence of the disease in these areas, the intensive distribution of poisoned bait was continued in the Belgut and Sotik Native Reserves during the year, to keep down carriers of the disease, and was maintained until the whole campaign in South Lumbwa was abandoned.

The position on the Sotik farms and the Buret Native Reserve, however, was not so satisfactory and caused considerable anxiety, especially about the middle of the year. Eight cases in all were confirmed by the examination of brains submitted to the Veterinary Research Laboratory, two from dogs and six from jackals. One of the rabid dogs was actually killed at Kilgoris in the Masai Reserve, but as the best means of approach to Kilgoris is by the Sotik farms, the case was dealt with by the Lumbwa veterinary staff.

In addition to the distribution of poisoned baits, a reward was offered for jackal tails. This, however, did not cause many jackals to be caught by the natives, even after the reward had been increased to a shilling a tail. By this time the prolonged baiting campaign had considerably reduced the jackal population, and probably the effort required by the natives to capture jackals was not sufficiently compensated by the reward. Also, experiments were carried out by setting traps of various patterns, but after a time these were abandoned, as it was found that the few jackals which remained were too wary to be caught, and only small carnivores of other species were trapped.

Thus, towards the end of the year, rabies having met with a decided check, all stray dogs having been destroyed, and the few jackals remaining could not be poisoned or trapped, it was decided to discontinue the rabies suppression campaign in South Lumbwa. Besides, a certain amount of alarm was being created by the increase in the numbers of rodents, hares and game birds, it was felt that the balance of nature had already been seriously upset and other serious complications might arise.

Contagious Bovine Pleuro-Pneumonia.—One outbreak of this disease occurred among squatter cattle on a farm near Chemelil. It was not until it was well established before it was reported. All the cattle on this and adjoining farms were vaccinated and the farm placed in quarantine. The origin of the disease was not traced but undoubtedly illicit movement was responsible although it could not be proved.

Ulcerative Lymphangitis.—Three cases were confirmed by microscopic examination, all three animals, two horses and a mule, were destroyed by their owners. Another highly suspicious case was reported, but the animal, a pony, died before the disease had been confirmed.

Horse Sickness.—The number of reported cases was two, both from the Molo area, but neither were confirmed although there was little doubt that one was positive, as it showed symptoms of "dikkop".

Haemorrhagic Septicaemia.—One outbreak of this disease occurred among work oxen. The disease has apparently been in existence for a short time before the department was asked to investigate it. It was fatal in about 50 per cent of the animals affected, the most noticeable symptoms were oedematous swellings over the quarter and laboured respirations. The disease was finally controlled after inoculating the cattle with a freshly prepared vaccine made from material obtained from infected animals in the herd.

Anthrax.—Two cases were confirmed by microscopic examination, both in isolated instances, but as the single spore vaccine was used after each, on contact animals, further deaths from that cause were probably prevented. From time to time reports are received of natives dying from anthrax in hospital, and the history usually points to their having consumed meat from an animal which had died suddenly; it can therefore be assumed that anthrax does occur throughout the district. Certain European farmers vaccinate their stock annually as they have experienced losses from anthrax in the past.

Trypanosomiasis.—Two outbreaks of this disease were recorded during the year.

General.—The year under review has not been without its trials for the stock farmer. The grazing never had a chance to recover from the depredations of locusts before the drought set in. The dairy farmer especially found that the milk yields dwindled to practically nothing, and growing stock were adversely affected, while draught cattle if not given supplementary rations either died or lost condition and were a long time before they again became serviceable. It has, particularly around Molo, proved to the stock farmer the necessity for laying in fodder, either in the form of hay or ensilage, because even in normal years during the dry season grazing becomes scarce and stock lose condition and suffer very considerably from exposure in their weakened state when the rains do set in. This district was generally not so severely affected by the drought as other parts of the country because, although the long rains failed, rain fell at the middle of the year and continued for about two months, thus bringing on the grazing. In parts of the district little or no rain fell after August, and grazing on certain farms had, by the end of the year, become scanty, which is a very serious state of affairs, as from then until March it is the normal dry season before the long rains begin. It is to be hoped, however, that some rain falls in the meanwhile.

Owing to the necessity for the rabies outbreak to receive prior attention, it was often not possible for the district staff to pay as much attention to stock problems as in other years. The total revenue collected for 1933 was Sh. 27,225/50.

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE IN MACHAKOS DISTRICT DURING THE YEAR AND THE THREE PREVIOUS YEARS

Disease	1930	1931	1932	1933
Rinderpest	..	5	8	5
Pleuro-pneumonia	1	..	..	..
Anthrax	..	1	1	..
Blackquarter	4	3	1	..
Horse Sickness	..	..	..	..

Machakos, Kiu and Kima Districts.

Rinderpest.—There were five outbreaks on farms during the year. All cattle on infected farms were double-inoculated so that there now remains no infection in this area. Vaccine-virus inoculations were carried out on three farms at which 1,602 head of cattle were inoculated. Reactions were marked in cattle which had not previously been vaccinated whereas there were no reactions in cattle which had been vaccinated. The total mortality recorded as resulting from these inoculations was three head.

Turning Sickness.—This disease causes a heavy mortality amongst cattle on many farms, in fact it is said to be responsible for more deaths than is East Coast fever. Two cases of cattle suffering from this disease were sent to the Veterinary Laboratory in order that an investigation into the disease might be carried out. Nothing definite has as yet eventuated but the Chief Veterinary Research Officer has asked that further cases may be sent.

Diseases of Equines.—No diseases affecting horses, etc., were reported during the year, but on two farms vaccination against horse sickness was carried out as a precautionary measure. Apart from swellings at the site of inoculation there were no untoward results.

Diseases of Sheep and Goats.—A severe infestation of wireworm caused a heavy mortality amongst sheep. The sheep were treated and deaths have practically ceased.

Machakos Quarantine Station.—The station has been open throughout the year for the immunization of cattle against rinderpest and also for East Coast fever testing. The fact that there has not been a great demand for these services may be accounted for by the present shortage of money. There has been a heavy mortality due to East Coast fever and to turning sickness, whereas that due to inoculations was very low. The numbers of cattle treated at this station are as follows :—

Double Inoculation		Serum Alone	E.C.F. Testing	
Adults	Calves			
625	21	482	229	Trade Cattle.
712	65	..	..	Native Owned Cattle.

COMPARATIVE SUMMARY OF OUTBREAKS OF DISEASE IN THE NAIROBI DISTRICT DURING THE YEAR AND THE THREE PREVIOUS YEARS

Disease	1930	1931	1932	1933
Rinderpest	13	3	13	7
East Coast Fever	9	1	3	32
Epizootic Lymphangitis	3	..	6	..
Ulcerative Lymphangitis	1	..	4	1
Anthrax	4	3	3	5
Bovine Pleuro-pneumonia	..	..	..	1
Swine Fever	..	1	..	..
Horse Sickness	..	1	2	..
Blackquarter	..	6	3	1

Rinderpest.—Seven outbreaks of rinderpest were recorded during the year. Of these, four occurred in the settled area and three in native reserves. Four inoculations were carried out by the district staff, of which two were in the settled area and two in the Kikuyu Reserve. Several settlers in the vicinity of outbreaks had their herds vaccinated against this disease.

East Coast Fever.—Many outbreaks were recorded in the district but only one in the Limoru "clean" area. This outbreak occurred on an unfenced farm contiguous to the Kikuyu Native Reserve.

Trypanosomiasis.—Five outbreaks of this disease were recorded during the year.

Lymphangitis.—Only one case of ulcerative lymphangitis was recorded during the year.

Anthrax and Blackquarter.—Several outbreaks were recorded and controlled by vaccination.

Haemorrhagic Septicaemia.—Two outbreaks were recorded amongst cattle and the disease was successfully controlled by a free issue of vaccine.

Foot and Mouth Disease.—Only three outbreaks were recorded during the year. The disease was mild in two of the three outbreaks but a heavy mortality was reported in the third.

Bovine Pleuro-pneumonia.—Only one outbreak was recorded in the district and is being controlled by quarantine. This disease was diagnosed amongst working oxen.

Quarantine Station for the reception of Imported Stock.—This station has been closed down during the year owing to the prevalence of a disease among cattle erroneously called Quarantinitis, which has been reported on in previous reports, and the desirability of moving the station to another position has been considered. Until a definite decision has been arrived at, the law governing the importation of animals has been amended, as a state of emergency, and now all cattle proceed direct to the farms which are proclaimed quarantine areas for the purpose of testing, etc.

During the year forty cattle were tested against tuberculosis and immunized against redwater and anaplasmosis. In addition, eight imported dogs were quarantined against rabies infection.

"Quarantine" disease reappeared among the cattle although, with two exceptions, the course of the disease was mild. One death was caused by this disease.

All tuberculin tests were successfully passed. Owing to the outbreak of "Quarantine" disease the period of detention has been considerably lengthened and the course of the red-water and anaplasmosis reactions was complicated and in consequence the publication of the usual annual tabulated results for this year would serve no useful purpose.

Nairobi Abattoir.—The percentage of condemnations for beef measles at the Nairobi Abattoir indicates an increase in infestation, both in grade and native cattle during the year. The total percentage of oxen condemned for *Cysticercus bovis* has increased during the past four years from 8.3 per cent to 15.6 per cent; in the case of grade beasts from 6.5 per cent to 11.1 per cent and native beasts from 9.4 per cent to 16.6 per cent. Measles is also prevalent in pigs. The heavy loss caused by these condemnations must seriously affect the economic prospects of an export trade, and an indication that stronger measures in sanitation are necessary in the use of pit latrines among natives living in the settled areas and native reserves is afforded.

ANIMALS SLAUGHTERED AND CONDEMNED
FOR ALL CAUSES

YEAR	GRADE			NATIVE			TOTAL		
	Killed	Condemed		Killed	Condemed		Killed	Condemed	
	No.	*No.*	*Per cent*	*No.*	*No.*	*Per cent*	*No.*	*No.*	*Per cent*
1927..	5,634	232	4·1	5,178	335	6·4	10,812	567	5·2
1928..	4,907	290	5·9	6,827	480	7·0	11,734	770	6·5
1929..	4,151	252	6·0	7,617	762	10·0	11,768	1,014	8·6
1930..	4,214	313	7·4	7,243	738	10·1	11,457	1,051	9·1
1931..	4,306	471	10·9	9,375	1,318	14·0	13,681	1,789	13·0
1932..	3,054	363	11·8	11,044	1,757	15·9	14,098	2,120	15·0
1933..	2,924	399	13·6	12,968	2,625	20·2	15,892	3,024	19·3

Slaughter Cattle from Masai Reserve to the Nairobi Abattoir, etc.—14,867 head of cattle were passed out from the Masai Reserve, under inspection and controlled movement during the year.

Agricultural Show.—A successful agricultural show was held in Nairobi at the end of the year. A comprehensive exhibit was shown by the department which fully represented the activities of the field and research divisions.

Mombasa.

The list as under of imported animals indicates that the importation of live stock was slightly less than last year, with the exception of poultry. It is an indication that the country is producing locally high grade animals for its requirements in increased numbers every year. The number of grade animals, cattle as well as sheep, for slaughter purposes from up-country was greater last year. It is due to established and increased business of the Stockbreeders' Association at this station. The number of cattle arriving on the Island from the Mainland and slaughtered has been slightly less than last year, but the number of sheep and goats has been considerably more than the year 1932.

Over 3,000 bundles of hides and 500 bundles of skins were exported this year more than 1932.

The comparative statement of the above figures for the last three years is as follows :—

	1931	1932	1933
IMPORTS	22 horses 91 cattle 50 sheep 12 pigs 68 dogs 7 cats	4 horses 33 cattle 37 sheep 2 pigs 42 dogs 1 cat	5 horses 20 cattle 22 sheep and goats 3 pigs 35 dogs 1 cat
FROM UP-COUNTRY— Grade Stock	786 cattle 595 sheep	766 cattle 550 sheep	866 cattle 1,885 sheep
SLAUGHTER STOCK DRAWN FROM MAINLAND— Live Stock Slaughtered at Mombasa Aboattoir ..	6,238 cattle 19,838 sheep and goats	6,721 cattle 24,073 sheep and goats	5,993 cattle 26,987 sheep and goats
HIDES AND SKINS EXPORTED			
Hides	5,172 bundles	3,525 bundles	8,788 bundles
Skins	410 ,,	429 ,,	953 ,,

The town authorities decided this year to enforce By-laws, viz. to subject all stock to anti-mortem examination by a Veterinary Officer before slaughter, and Veterinary Assistant, Mombasa, commenced the inspection from the month of November, 1933, and up to the end of December 79 cattle and 121 sheep and goats, suffering from abnormal temperatures and diseases such as trypanosomiasis, East Coast fever, etc., were rejected. This represents about 10 per cent cattle and 3 per cent sheep and goats. The anti-mortem examination was decided upon and enforced immediately by the town authorities due to the fact that a number of cases of anthrax were reported in the slaughter house. The percentage of rejections further prove the serious danger to which the consumers were exposed in the absence of this important examination.

The established dairies on the Coast were able to continue their business, although cases of trypanosomiasis and East Coast fever have caused mortality. The trypansome infection responds to the treatment of injections of Antimosin and dips have been erected to combat the East Coast fever tick.

Rinderpest.—Two outbreaks of the disease appeared in Mombasa Island and district, the first in a dairy herd and the second on a farm at Changamwe. The outbreaks were controlled by serum alone method, and slaughtering of the sick animals on the appearance of the first symptoms and burning them. The disease in the Island was stamped out with the loss of two cows slaughtered and no fresh case appeared. At Changamwe the outbreak was also dealt with by the serum alone method. The infected herd was comprised of native stock with the result that, although 20 per cent suffered from the disease, all recovered. In both the outbreaks the infection was traced to the movement of stock from Tana River.

Anthrax.—An outbreak of this disease was diagnosed in a dairy herd in the Island. One animal died suddenly. The vaccination of the remaining herd was carried out and there has been no further case observed in that herd. The other cases were diagnosed in the slaughter house, Mombasa, among slaughtered animals. They evidently contracted disease on the Mainland and were slaughtered when sick. Such accidents will be eliminated now that the anti-mortem examination is being enforced and carried out by the Veterinary Assistant, Mombasa.

General.—This year the season has been very unusual. The rains whenever they fell were out of date, so that the time of year which should have been hot and sunny, was cool due to untimely showers. This was responsible for the severe outbreak of disease among native cattle at Likoni, together with the arrival of a number of cattle from East Coast fever-free areas.

Branding of Stock.—During the year the following brands were issued or otherwise dealt with :—

"S" brands supplied	6
Renewal brands supplied	3
Brands registered	60
Brands transferred	6
Brands cancelled	1

Permit System.—During the year the following changes took place in the personnel of honorary permit issuers of permits :—

Remaining 31st December, 1932 ...	140
Remaining 31st December, 1933 ...	134
New appointments	18
Resignations	19
Deceased	5

The opportunity is taken to record the appreciation of this staff for the valuable assistance rendered by these gentlemen, not alone to the department, but also to the stock trade in general.

RETURNS FROM THE GOVERNMENT DIPPING STATIONS FOR THE LAST FOUR YEARS

STATION	EQUINES				CATTLE				SHEEP AND GOATS			
	1930	1931	1932	1933	1930	1931	1932	1933	1930	1931	1932	1933
Nakuru	1	41	230	438	1,993	1,826	6,750	2,179	24,518	29,570	33,817	40,066
Isiolo	112	134	29	98	..	..	..	..	70,295	69,851	68,160	41,716
Nanyuki	18	8	..	..	25,681	32,485	29,836	25,260	..	..	..	..
Rumuruti	..	..	..	..	1,980	4,831	12,772	9,768	1,879	384	122	..
Naivasha..	..	..	..	..	15,256	10,892	13,433	18,390	15,631	15,935	15,278	13,453
TOTALS	131	183	259	536	44,910	50,034	62,791	55,597	112,323	115,740	117,377	95,235

N.B.—Total number of cattle dips in the Colony is 381. Total number of sheep dips in the Colony is 105.

During the year 515 dipping fluid samples were analysed by the Senior Agricultural Chemist,.

(a) (ii) NATIVE RESERVES.

NATIVE VETERINARY SERVICES.

Educational.—Instruction of the native in all branches of the live stock industry, including disease control and animal husbandry, is given at certain educational centres known as African Veterinary Training Centres, located at different points in the pastoral reserves. The following is a list of these training centres, indicating the area served by each station: Ngong, Masai District; Maseno, Nyanza Province; Sangalo, Nyanza Province; Baraton, Rift Valley Province; Machakos, Central Province; Isiolo, Northern Frontier District; Mariakani, Coast Province (partly developed). More than one hundred pupils were in residence at the end of the year. The course of instruction extends over a period of two years. A complete syllabus has been arranged and lectures and demonstrations are given according to schedule, which contain essential instruction and demonstration in the control and treatment of animal disease, and the general principles of animal husbandry, including poultry, as applicable to the native pastoral industry.

It has been impossible to extend the scheme to cover additional areas in answer to requests, owing to financial stringency. Satisfactory and steady progress has been made during the year at all these centres, except Isiolo, although there is evident a growing desire on the part of pastoral tribes to take advantage of the training. Experience has shown that pupils should have a fair primary education in order that they may at once be in a position to commence technical studies. For this reason preference is given to natives of Primary School Certificate grade; only approved native teachers are employed in the training centres.

African Veterinary Training Centres are located within or convenient to the native areas, which they are intended to serve, and afford easy access to the elders and all other members of the tribes, to observe for themselves from time to time the various activities of the training centres, particularly in relation to stock development by modern methods of animal husbandry. The herds of cattle maintained at the training centres are the types familiar to the pupils and for this reason they are in a favourable position to notice the value of modern methods of management in comparison with their primitive tribal customs.

Each training centre is under the direct supervision of a Veterinary Officer, assisted by a Stock Inspector or instructor in stock, and the requisite trained native staff. The Veterinary Officer is also in charge of the neighbouring native reserves and carries his duties amongst the tribes in an extension to the teaching carried out at the training centres, particularly in regard to disease control, and the production, preparation and marketing of stock products.

Having completed the course, some of the pupils are retained by the division, many are employed by European stock owners and others again return to their reserves, where they have opportunities of turning their training to a practical use on their own stock. Indeed some have started in a business-like manner by building and organizing field dairies for the production of ghee or butter-fat, and hide shade-drying bandas, as commercial propositions, for the better preparation of hides. This form of enterprise is encouraged and assisted in every possible way by the administration and the division.

Ngong African Veterinary Training Centre—Masai District.

Staff.—One Veterinary Officer, also in charge of the Narok district; one Stock Instructor.

Accommodation is provided principally for Masai pupils, and these are accepted from the African native schools at Narok and Loitokitok, to the number of forty; as the full quota of Masai was not found, accommodation was provided for four Wakikuyu and two Wakisii natives. Funds from the Fort Hall Local Native Council were provided for the expenses of the four Wakikuyu. There was a total of thirty-five pupils in residence during 1933, thirty-one of which were Masai and four Wakikuyu. Competitions were held monthly in milking, butter-making, ghee-making and milk testing. A small prize was awarded and the pupils showed great keenness in competing.

Agricultural Show.—An exhibit from this station was sent to the Royal Agricultural and Horticultural Society's Show held in Nairobi, December, 1933, but, as stated elsewhere, on account of disease it was impossible to exhibit cattle. The pupils gave demonstrations of butter- and ghee-making in field dairies and in the dairy kindly lent by a trade firm. Two "Highly Commended" awards were gained for dairy produce. A stall in which was displayed records of several of the station cattle, samples of butter and ghee, Masai plants and grasses, etc., was also filled. During the latter part of the year there were several enquiries from stock farmers who required trained boys.

Dairy Produce.—Thirty-four frasilas (36 lb.) of ghee were sold during the year, realizing more than Sh. 915. Eight frasilas of ghee sold in January, 1934, were made in December, 1933. One hundred and sixty pounds of ghee were sent to England in an endeavour to find a market there and six frasilas were sent to Zanzibar for the same purpose. Forty pounds of cream were utilized for ghee-making experiments.

Hides.—Hides to the number of 440 have been treated by pupils to the personal gain of the local Somali butcher, who has continued to loan the fresh hides for demonstration and practice purposes.

Inoculations, etc.—All farm cattle were vaccinated against pleuro-pneumonia, rinderpest and anthrax, and the younger stock against blackquarter. This work was carried out by the pupils under the supervision of trained scouts. Approximately 1,200 head of native-owned stock were vaccinated against pleuro-pneumonia by the pupils, who, under the supervision of veterinary scouts, made safaris to the bomas concerned. As each animal received three vaccinations, it will be seen that the pupils had good opportunities of practising field technique.

Dipping.—In view of cases of tick-borne disease having been experienced in November, seven-day dipping has been changed to a five-day period and hand-dressing was adopted.

Fences.—Much damage by game has been experienced and the labour has been constantly engaged in repair work.

East Coast fever.—A case of the disease occurred in the native test herd during the month of November, which unfortunately prohibited animals being placed on exhibit at the Nairobi Show in December, a great disappointment to all concerned.

Colon Bacillosis.—This disease has persisted, although all known steps have been taken to effect eradication.

Blackquarter.—Two cases occurred during July.

The Local Native Councils of the Masai, Kisii and Ukamba Provinces visited the station during the year, and were impressed by the yields of the cattle.

Rainfall.—The total rainfall for the year has been 10.67 inches.

Stock.

Cattle.—The numbers on hand on 31st December, 1933: Boran, 70 head; Masai, 59 head; Grade, 156 head.

Sheep.—102 head. Transfers to other stations: To Machakos, 33 sheep; to Maseno, 1 ram. Sales: Rams to Masai at Sh. 10 each, 25. Total increase: 43.

Total Stock on Charge.—Cattle: native, 70; and 59; grade, 156; bullocks, 45; sheep, 102; donkeys, 26; horses, 3: Grand total, 461.

Native Calves.—All calves are hand-fed and are weighed at birth, at weekly intervals and later at intervals of one month. The liveweight increase has been calculated and the average gain per head per day is .69 lb.

The total ration per calf fed up to six months is as follows: Whole milk, 35 gallons; separated milk, 200 gallons; concentrates, nil; good quality hay is always available. Increased rations are fed to bull calves out of high-yielding cows intended for breeding purposes in the herd.

The average birth weights recorded: Boran type, 40 lb.; Masai type, 30.8 lb.

Milk Separated from Native Herd, Ngong, 1933.—3,388 gallons milk; 3,328¾ lb. cream; 214½ lb. butter; 1,554 lb. ghee (21.7 lb. milk equals 1 lb. ghee).

In comparing the above figures with those of 1932, we find an increased amount of milk necessary to produce one pound of ghee, this may be a reflection on the poorer nutritional condition of the animals during the year because of the drought.

The average number of native cows in milk throughout the year was twenty-five, and the total figure shown in the report is the surplus milk, sent to the separator, after all calves had been fed. The native herd was handled by experienced native milkers.

Milk Separated from the Grade Herd, Ngong, 1933.—2,793 gallons milk; 1,989 lb. cream; 1,234 lb. butter; 847 lb. ghee (33.1 lb. of milk equals 1 lb. ghee).

The surplus of milk is only recorded from an average of thirty-one grade cows in milk during the year. The herd was hand-milked by natives under training. The records are published in no way to compare the milking abilities of native and grade cows.

The following table shows the performance of the Boran cattle over one, two, three and four lactations. The poor condition of the pasture is reflected in the diminished lactation milk yields for 1933.

BORAN COWS LACTATION YIELDS, NGONG

Cow No.	Yield First Lactation	Time in Milk Days	Percentage Butterfat	Yield Second Lactation	Time in Milk Days	Percentage Butterfat	Yield Third Lactation	Time in -Milk Days	Percentage Butterfat	Yield Fourth Lactation	Time in Milk Days	Percentage Butterfat
	Gallons		*Per cent*	*Gallons*		*Per cent*	*Gallons*		*Per cent*	*Gallons*		*Per cent*
4 . .	272	240	6	240	240	5·9	258	246	6	240	247	5·88
5 . .	No milk	—	—	213	242	5·5	240	243	5·8	143	155	5·8
12 . .	197	255	5	196	194	6·2	—	—	—	—	—	—
22 . .	No milk	—	—	242	247	6·1	189	200	6	—	—	—
24 . .	No milk	—	—	338	264	5·9	214	238	6·2	330	243	6
25 . .	217	200	5	469	272	6	248	244	5·9	—	—	—
30 . .	187	192	6	260	278	6	—	—	—	—	—	—
31 . .	No milk	—	—	257	283	5·5	270	215	5·8	193	200	5·9
44 . .	No milk	—	—	180	228	5·7	193	217	6	159	206	6
70 . .	257	240	5·9	265	225	5·8	235	212	6·1	—	—	—
80 . .	157	215	5	210	236	5·2	217	283	5·1	—	—	—
81 . .	143	206	6	349	225	5·9	342	205	6·1	—	—	—
82 . .	125	200	5·7	169	200	6	202	199	5·8	188	178	5·76
88 . .	No milk	—	—	140	216	6	197	143	6·2	134	140	6·4
94 . .	138	225	5·9	101	191	5·8	—	—	—	—	—	—
97 . .	149	168	6	201	220	6	246	208	5·9	220	205	6·6
98 . .	259	199	6·2	253	210	6	300	230	5·9	194	200	6·8

MONTHLY YIELDS OF MASAI HEIFERS, NGONG

Cow Number	Months Milking									Days in Milk	Average Daily Yield	Total in Gallons and Lb.		Butter-fat Content
	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Ninth					
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*		*Lb.*	*Gallons*	*Lb.*	*Per cent*
9.. ..	69¾	310¾	244¼	234¼	177¾	134	123½	133¾	—	221	6·4	143		6·6
7.. ..	321¼	311	300¾	256¾	271¾	198¼	123¾	90	—	228	8·2	187	3	6·4
11.. ..	220½	416	283½	235½	193	142¾	200½	218¾	In milk	230	8·3	191		5·9
13.. ..	114	197	193¾	225½	250¼	In milk	—	—	—	136	7·2	98		5·5
28.. ..	122	241¾	250¾	186¼	129¾	97¼	In milk	—	—	167	6·1	102	7	6
84.. ..	42¾	280¼	262	244½	199	141¾	123	161	167¾	249	6·5	162	2	5·8
135.. ..	163¾	363	385¼	In milk	—	—	—	—	—	96	9·5	91	2	5·7
136.. ..	99	307	In milk	—	—	—	—	—	—	41	9·9	40	6	5
170.. ..	18	75¾	In milk	—	—	—	—	—	—	36	2·5	9	3¾	6
172 No milk	—	—	—	—	—	—	—	—	—	—	—	—		—
173.. ..	107¼	182½	129½	103	130½	141	In milk	—	—	179	4·4	79	3	6·2
174.. ..	42¼	176½	126½	116¼	113¾	122¼	106	73½	72½	241	3·9	94	9½	7
175.. ..	122½	302	250	In milk	—	—	—	—	—	73	9·2	67	4½	5·4
178.. ..	238¾	239¼	219	In milk	—	—	—	—	—	78	8·9	69	7	5·8
179.. ..	119¾	215¼	216	In milk	—	—	—	—	—	79	6·8	55	1	4·9
180.. ..	17	187¾	148½	159½	In milk	—	—	—	—	94	5·4	51	2¾	4·6
182.. ..	58½	208	148¼	143	144½	115¾	134	In milk	—	189	5·3	95	2	6
184.. ..	186	220¼	226¼	In milk	—	—	—	—	—	87	7·2	63	2½	4·9
185.. ..	156½	227½	236	189	155¼	119	79¾	82	—	231	5·6	129	5	5·6
188.. ..	93¼	88¼	60¼	—	—	—	—	—	—	89	2·7	24	1¾	7

MONTHLY YIELDS OF MASAI HEIFERS, NGONG

Cow Number	Months Milking									Days in Milk	Average Daily Yield	Total in Gallons and Lb.		Butter-fat Content
	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Ninth					
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*		*Lb.*	*Gallons*	*Lb.*	*Per cent*
190 No milk	—	—	—	—	—	—	—	—	—	—	—	—	—	—
189.. ..	216	279½	In milk	—	—	—	—	—	—	58	8·5	49	5½	6·3
191.. ..	122½	301½	268	In milk	—	—	—	—	—	93	7·4	69	2	5·3
192.. ..	267¼	181¾	108½	123½	57¾	In milk	—	—	—	150	4·9	73	8¾	6·6
193.. ..	41½	278½	272½	244½	195¾	161	141	100	—	217	6·6	143	4½	5·9
194.. ..	253	218¾	275¾	192¼	143	In milk	—	—	—	151	6·5	98	2¾	5·5
197.. ..	220¾	278½	215¾	176	142½	183½	188¾	In milk	—	209	6·7	140	5¾	5·5
198.. ..	81	In milk	—	—	—	—	—	—	—	12	6·7	8	1	—

The Masai heifers were a starved trade lot bought in the Reserve and not specially selected. Twenty-eight of them have calved out of 41 and the monthly yields average percentage butterfat, and average daily yields are tabulated above. Considering the severe drought and the poor condition of the cattle their performance is very satisfactory.

Number of cows tested—28. Number of days in milk—3,632. Number of lb. produced—23,384½. Average daily yield—6·5

Maximum daily yield—9·9. Minimum daily yield—2·7

Sheep.—The number of sheep in the flock at the beginning of 1933 was 118, the number at the end of the year was 102. This is explained by the fact that the following transfers took place—thirty-three were sent to Machakos and one ram was sent to Government Farm, Naivasha; twenty-five were sold to the Masai and Kikuyu, who were very willing to pay Sh. 10 per head. The objects of maintaining the flock is to build up a typical strong one-colour flock of Masai sheep, to breed good rams for use in the reserve and the year has seen these objects fulfilled. Experiments to obtain two crops of lambs per year have been put in hand. The ewes were mated in September and should lamb down therefore at the end of February. The rams will again be put to the ewes in March and the next crop of lambs should be born in August. The rams will again be introduced in September. Two rams were selected for stud purposes and were exhibited at the Nairobi Agricultural Show. The flock is now, with very few exceptions, of one colour and may be said to be composed of good typical animals of the Masai type.

Maseno Veterinary Training Centre (Central Kavirondo Reserve)—Nyanza Province.

Staff.—One Veterinary Officer (also Veterinary Officer, Central and South Kavirondo Reserves); one instructor in stock.

TYPE OF ANIMAL	BREEDING STOCK				
	1929	1930	1931	1932	1933
Bulls	—	2	3	1	1
Cows	5	42	113	100	81
Heifer (2-year old)	—	—	—	3	8
Heifer (yearling)	—	—	—	9	15
Heifer calves	—	5	13	19	30
Bulls (over 1 year old)	—	—	—	5	10
Bull calves	—	1	7	7	10
Net Total	5	50	136	144	155
Purchased	5	39	121	11	1
Births	—	14	28	44	6
TOTAL	5	53	149	55	72

Mortality.—The deaths are composed as follows: Two young bulls purchased for breeding purposes were later found to be useless so were slaughtered; ten cows and heifers died as the result of mineral poisoning; one heifer was killed, one cow broke her leg, four cows were slaughtered for contagious abortion, and one cow died (cause of death unknown). Twenty-two bull calves were slaughtered at birth owing to milk shortage, unthriftiness, malformation, etc., and nine heifer calves (two slaughtered owing to being malformed, two vegetable poisoning, one snake bite and four from causes unknown). One bull calf with skin disease was transferred to Kabete. Ten heifers and cows were culled for contagious abortion and having no milk. All these have been replaced by maiden heifers. Thirty-three cows were tested for contagious abortion by the Veterinary Research Laboratory at Kabete. Of these fourteen were proved positive and five doubtful. Facilities are now available at the station for carrying out these tests.

The following live stock is also on charge at this station: fifty-nine working oxen, ten donkeys and seventeen sheep. There were two deaths among the working oxen—one from snake bite and the other from senile decay.

Four cows contracted foot and mouth disease during their first lactation in 1931 and although they continued to milk after recovering from the disease, on calving down for the second time they produced no milk whatsoever. These were culled and replaced.

AVERAGE DAILY OF MILK YIELD

YEAR	Total Milk Yield in Lb.	Number of Cow Days	Average Yield per Cow per Day in Lb.
1931	11,561·0	2,605	4·43
1932	27,443·1	5·457	5·03
1933	50,502·8	8,454	5·97

Calf weights.—The average birth weight of heifer calves was 35.3, and bull calves 35.8. The average birth weight of first calves was 34.4, second calves 35.8, third calves 38.5, and fourth 38.0. The average birth weight of the sixty-two calves born during 1933 was 35.3 lb., an increase of .8 lb. over last year. Bull calves were on an average only .5 lb. heavier than heifer calves. The total average gain per day of calves in 1932 was .66 lb., and in 1933, .64 lb.

It will be noticed that there is a slight decrease in the total average gain per calf as compared with the 1932 figures. This decrease may be attributed to an outbreak of foot and mouth disease among the cows, which caused a few cows to give no milk on calving down again; other cows had no milk at all during their first lactation and a few calves contracted a skin disease, the cause of which is still being investigated. In the majority of cases a recovery is effected but the growth and weights of the calves are considerably retarded. The condition of the other calves throughout the year was fairly good.

The following table gives a comparison of lactations of the cows during the year. It will be noticed that cows Nos. 11 and 32 have each produced over 200 gallons per lactation for two lactations, and it is intended to group these two separately as "test" cows.

COMPARISON OF LACTATIONS

No. of Cow	1st Lactation				2nd Lactation				3rd Lactation				4th Lactation			
	Yield	Days in Milk	Average per day	Average Butter-fat	Yield	Days in Milk	Average per day	Average Butter-fat	Yield	Days in Milk	Average per day	Average Butter-fat	Yield	Days in Milk	Average per day	Average Butter-fat
	Lb.		*Lb.*	*Per cent*	*Lb.*		*Lb.*	*Per cent*	*Lb.*		*Lb.*	*Per cent*	*Lb.*		*Lb.*	*Per cent*
32 ..	2,054	356	5·7	—	2,510	244	10·2	—	3,016	251	12	5·6	1,698	*117	14·5	5·1
28 ..	—	—	—	—	1,914·5	299	6·4	—	627·4	193	3·2	3·2	—	—	—	—
16 ..	978·9	302	3·2	—	1,443·4	296	4·8	—	582·5	134	4·3	5·1	—	—	—	—
11 ..	2,053	348	5·9	—	2,022·7	256	7·9	7·7	1,241·3	*102	12·1	5·9	—	—	—	—
37 ..	991	207	4·7	—	1,041·9	177	5·8	6·9	998·4	*163	6·1	6·1	—	—	—	—
73 ..	924·3	261	3·5	—	1,412·5	221	6·4	5·8	895·9	*122	7·3	5·6	—	—	—	—
27 ..	200	176	1·1	—	516·1	147	3·5	5·6	606·3	*107	5·6	7·3	—	—	—	—
7 ..	—	—	—	—	888·7	229	3·8	5·6	1,407·4	199	7·0	6·1	—	—	—	—
24 ..	549	281	1·9	—	—	—	—	—	263	82	3·2	7·3	—	—	—	—
105 ..	552·7	139	3·9	—	1,008·9	179	5·6	6·5	345·3	*42	8·2	6·0	—	—	—	—
44 ..	918·6	168	5·4	5·9	415·5	*56	7·4	5·1	—	—	—	—	—	—	—	—
57 ..	166·7	143	1·1	—	1,493·5	211	7·0	6·7	—	—	—	—	—	—	—	—
62 ..	—	—	—	—	78·3	25	4·5	—	—	—	—	—	—	—	—	—
74 ..	1,671·9	246	6·7	—	962·9	183	5·2	6·8	—	—	—	—	—	—	—	—
92 ..	500	127	4·0	—	860·1	177	4·8	6·3	—	—	—	—	—	—	—	—
102 ..	616·5	191	3·2	—	749·5	*68	11·0	5·9	—	—	—	—	—	—	—	—
106 ..	1,772·7	288	6·1	5·7	886·4	*69	12·8	4·6	—	—	—	—	—	—	—	—
110 ..	1,107·5	136	8·1	—	507·2	93	5·3	—	—	—	—	—	—	—	—	—
121 ..	1,654·3	270	6·1	5·6	969·6	*94	10·3	5·7	—	—	—	—	—	—	—	—
123 ..	—	—	—	—	614·5	*109	5·6	6·2	—	—	—	—	—	—	—	—
128 ..	329·9	127	2·5	—	307·7	86	3·5	6·2	—	—	—	—	—	—	—	—

*Still milking.

Poultry.—The Rhode Island Red breed of poultry only is now retained at Maseno. The Australorp breed was found to be unsuited to local conditions and was disposed of. Native hens were used throughout the year for the hatching out of chicks. This system has been found to be unsuited to local conditons and was disposed of. Native hens were used throughout the year for the hatching out of chicks. This system has been found to be very unsatisfactory and uneconomical owing to the heavy parasitical infestation introduced by this method. Six hundred chicks were reared on the farm during the year and were distributed throughout the reserve.

It is regretted that the number of chicks reared was not in excess of the above-quoted figure. The mortality among both chicks and young birds was very high throughout the year owing to varying conditions, such as internal parasites, the siafu ant, wild animals, hawks, heavy rains, etc. From the experience now gained it is anticipated that the poultry will do better in the future, as several of the above difficulties have been overcome towards the latter part of the year.

Sheep.—A small mob of twenty-four weaner ewe lambs was purchased locally. Two have since died and five were mauled by a leopard. The total remaining on hand is seventeen. A good type of Masai ram will cross the poor indigenous type and by this method it is hoped to build up a better type of sheep and introduce new blood by the distribution of rams in the reserve.

Dogs.—Owing to outbreaks of rabies in the Nyanza Province, kennels were erected at Maseno in June for the reception of dogs. Seven dogs were received during the course of the year. One died as the result of snake bite and three were released, three remaining on hand at the end of the year.

Pasture and Crop Development.—179 acres of land were cleared of bush, ploughed and planted with a mixture of Kikuyu grass and Naivasha Star grass. A further area of approximately five acres was ploughed and prepared for planting which was postponed owing to lack of rain. Maseno is fortunate in its grazing, which remains in a fair condition throughout the year owing to an evenly distributed rainfall.

Lucerne.—The original patch of lucerne planted up in 1931 has been discarded and a block of approximately three acres was planted up during 1933.

Maize.—Six acres of maize were planted up in March. 120 bags were reaped from this block in August, an average of twenty bags per acre. A further four acres was planted up in August and should yield a fairly heavy crop.

Edible Canna.—The edible canna roots planted out in 1932 are spreading rapidly and it was therefore not considered necessary to extend the present area.

Sunflower.—One acre of sunflower was planted up during 1933 yielding twelve bags and has proved an excellent poultry feed.

Pupils.—Thirteen new pupils were admitted to the Training Centre in March and May, bringing the total to twenty-seven. Two were returned to their homes as being unsuitable after a trial, leaving twenty-five at 31st December, 1933. All the work in connection with the cattle and poultry is done by the pupils under a working instructor in each department. Practical instruction was given in the following subjects: milking, treatment of cows and heifers prior to and at calving; treatment of the new-born calf; hand-rearing of calves; milk recording; butter and ghee-making; care and cleansing of dairy utensils; use of the themometer; building construction; castration; flaying of hides; preparation and shade-drying of hides; method of opening up a carcass for post mortem examination; post mortem appearance of various organs; study of the different types of cattle; inoculating of fowls and cattle; dipping; poultry husbandry; agriculture—ploughing, preparation of soil and manuring. The time table is so arranged that the pupils have on hour per day in which to play games. The main sport is association football, and several matches were arranged with neighbouring teams. The following subjects were dealt with in the lectures: the symptoms, cause, diagnosis, treatment, prevention and post mortem appearances of the major and more prevalent diseases, including poultry diseases. Animal Husbandry—the general elementary principles. Eleven pupils sat for their elementary general knowledge examination in 1933, of whom eight passed and three failed. Of the ten pupils who sat for this examination in December, 1932, only one passed. Three pupils entered for their primary general knowledge examination in November, 1933, of whom two passed and one failed. Examinations on the subjects dealt with in the lectures were held in June and November. Sixteen pupils were above and nine below the average ability. No pupils completed their courses of instruction during 1933. Some thirteen pupils are due to complete their courses in the early part of next year.

Revenue.—The total amount of revenue obtained from the sales of farm produce during the year was Sh. 2,865/57 as compared with Sh. 2,126/80 during 1932.

Kisiani Dairy.—During the twelve months ending 31st December, 1933, 18,574.6 gallons of milk were received at the Local Native Council Dairy at Kisiani, at a cost of Sh. 3,483/16. 176 tins of ghee were sold at an average price of Sh. 21 per frasila, which was slightly below the average price obtained during 1932, namely, Sh. 22/68 per frasila.

MILK SUPPLY TO KISIANI DAIRY

MONTH	Milk bought in gallons	Cost per gallon	Disbursement		Number of Milk Suppliers
		Cents	*Sh.*	*cts.*	
January ..	1,575·8	20	315	16	80
February ..	1,409·5	20	281	90	76
March ..	1,490·2	20	298	04	76
April	1,350·7	20	270	14	81
May	1,479·4	20	295	88	78
June	1,521·7	20	304	34	81
July	1,520·0	15	228	00	94
August ..	1,798·4	15	269	76	100
September ..	1,646·0	16	263	36	87
October ..	1,630·4	20	326	08	87
November ..	1,515·5	20	303	10	84
December ..	1,637·0	20	327	40	90
TOTAL ..	18,574·6	18·83 average per gallon	3,483	16	84·5 average per month

MILK SUPPLIES AND COST FOR THE LAST FIVE YEARS

YEAR	Milk received in gallons	Daily supply in gallons	Price per gallon	Disbursement	
			Cents	*Sh.*	*cts.*
1929 ..	8,802·5	24	40	3,521	00
1930 ..	10,561·5	29	32	3,379	68
1931 ..	8,521·0	23	32	2,733	59
1932 ..	11,361·2	31	20·8	2,364	73
1933 ..	18,574·6	51	18·8	3,483	16

The dairy is conducted under veterinary supervision. For the first ten months of the year the cream was transported to Maseno and made into ghee by the pupils at the Veterinary Training Centre. During November and December the cream was sent to the Co-operative Creameries at Lumbwa. The following table indicates the quantities and qualities of cream supplied during these two months :—

MONTH	1st Grade	2nd Grade	3rd Grade	Total
	Lb.	*Lb.*	*Lb.*	*Lb.*
November ..	439·2	227·2	—	666·4
December ..	381·2	206·9	126·0	714·1
TOTAL ..	820·4	434·1	126·0	1,380·5

Rainfall.—The total rainfall for the past three years is as follows : 1931, 61.14 inches ; 1932, 59.78 inches ; and 1933, 46.01 inches. The number of days on which rain fell was : 1932, 172 days ; 1933, 166 days ; the number of days on which over .1 of an inch fell was : 1932, 152 days ; 1933, 166 days. The longest spell without rain : 1932, 15 days ; 1933, 17 days. The highest rainfall on any day during 1933 was 1.49 inches.

Sangalo African Veterinary Training Centre (North Kavirondo Reserve)—Nyanza Province.

Staff.—One Veterinary Officer, also in charge of North Kavirondo District ; one Stock Inspector.

The following table shows the number of breeding stock on the farm at the end of the year, together with a comparison with the previous year :—

	1932	1933
Bulls	1	2
Cows	25	60
Heifers (two years old) ...	37	32
Heifers (yearlings)	7	13
Bulls (yearlings)	3	9
Heifer calves	11	7
Bull calves	3	12
	87	125

Deaths, 20. Abortions, 1. 33 cows calved. 27 heifers have not yet produced a calf and 41 cows were in milk during the year. Number of completed lactations: 24. Number of uncompleted lactations: 17.

Total Milk Yield	Cow Days	Average yield per Cow per day
lb. 15,731	3,073	lb. 5·01

Particulars of Cows in Milk at 31st December.

No. of Cows	Yield to 31–12–33	No. of days in milk	Daily Yield at 31–12–33	Highest daily Yield
	gal.		lb.	lb.
64	132·6	172	6·3	9·5
45	39·5	62	3·8	7·7

Butter fat percentage varied from 4·5 to 7·5.

Comparison between 1st and 2nd Lactations.

No. of Cow	1st Lactation		2nd Lactation	
	Yield gals.	Days in Milk	Yield gals.	Days in Milk
22	202·1	304	163·7	233
10	69·6	239	183·6	283
20	77·3	270	136·2	246
27	109·3	318	126·5	200
18	1·2	19	81·4	128
6	14·	32	125·3	196
19	108·3	180	·7	16

Comparison between Average Daily Yields in 1st and 2nd Lactations.

No. of Cow	1st Lactation	2nd Lactation
	lb.	lb.
22	6·7	7·0
10	2·9	6·5
20	2·8	5·6
27	3·4	6·3
18	·6	6·3
6	4·3	6·4

Consideration of Milk Records of the Sangalo Native Dairy Herd.—Thirty-one cows have completed normally one lactation and several have completed two lactations. Of these thirty-one cows, fourteen have given a reasonable amount of milk; ten of them have only completed one lactation and, as it has been observed that native cows which give little milk in the first lactation very often milk well in the second, the percentage of good milking cows will probably prove to be much greater.

One cow has exceeded 200 gallons; three have exceeded 150 gallons; four have exceeded 100 and six have exceeded 50 gallons. It is evident that while the percentage of good milking cows among North Kavirondo cattle may not be a very high one, there are some cows which are capable of giving a good milk yield. It must also be emphasized that such cows are productive under conditions which would be quite unsuited to grade cattle. The prospects of improvement in such cattle by selective breeding are considerable.

Calves.—The number born in 1933 was twenty-nine; twelve heifers and seventeen bulls.

Average birth weights were : 1931, 34 lb.; 1932, 36.3 lb.; and 1933, 39.5 lb.

Comparison of birth weights of 1st and 2nd calves.

No. of Cow	1st calf	2nd calf
	lb.	lb.
22	34·5	27
10	31·5	37
20	32	33
27	34	41
18	27	32
6	35	33
19	44	37

The heaviest calf born weighed 51 lb.

Calf Weights (calves were weaned on reaching 150 lb.).

No. of Cow	Sex	Birth weight	Weight at 26 weeks	Average daily gain
		lb.	lb.	lb.
10	F.	31·5	151	.66
21	M.	40	115	.31
39	M.	44	68	.15
11	F.	41	116	.31
62	F.	37	77	.22

Calf	Dam	Average daily increase in weight	Age at weaning
			weeks
121	56	·85	23
119	70	·70	25
110	10	·66	26
111	21	·49	32
114	11	·47	33
115	62	·36	46

Weight of bull calves averaged 41 lb. and weight of heifer calves averaged 37 lb.

Disease.—Stock was immunized against Colon bacillosis, paratyphoid, anthrax, blackquarter and rinderpest. Cows were tested frequently for contagious abortion. There were three reactors to the contagious abortion test (i.e. 5 per cent of the herd) one of which aborted.

Fencing.—Two miles of internal fencing were erected in making five paddocks. One of fifty acres, one of thirty acres and three of four acres each. All the old fencing on the farm was repaired.

Building.—A bull house consisting of three boxes was erected. A cattle dipping tank has been completed except for the roof and paddocks.

Cultivation.—Two crops of maize were planted. Three acres planted in the long rains yielded eight bags to the acre, the first crop obtained from this particular bit of land. Seven acres were planted in September and should yield a good crop. Sufficient edible canna roots were obtained from last year's crop to plant up one-and-a-half acres. Lucerne has been planted out on various parts of the farm to find out the part in which it grows best. One-and-a-half acres of sunflower was planted to provide food for cattle and poultry. An acre of beans which was growing well was unfortunately destroyed by game. A particularly marshy part of the farm has responded well to drainage and has been ploughed up to provide a permanent shamba, fifty acres in extent, for growing crops for cattle and poultry.

Grass.—A fifty-acre paddock, planted with Naivasha Star grass, has been in use for grazing for some months. A good cutting of hay was obtained from this paddock. A few acres of Kikuyu grass have been planted. This grass grows much more slowly than the Star grass. The chief difficulty experienced in improving pastures by ploughing and planting grass is keeping down weeds. An experimental grass plot has been started with the following grasses collected locally : *Trichopteryx kuragensis* (*Weuwe*) ; *Hyparrhenia rufa* (*Makali*) ; *Paspalum scrobiculatum* var. *commersonii* (Namasambu) ; *Hyparrhenia ruprectii* (Namaskamu) ; *Eragrostis tenuifolia* (Olusowangira) ; *Hyparrhenia sp.* (Lugongo) ; *Brachiaria sp.* (Shifwamolo) *Panicum* sp. nr. *P. Masiense* (Lumbuku).

Trees.—A large number of trees was planted, comprising 4,600 gums, 4,400 cypress, 6,000 local trees and an acre of wattle.

Rainfall for the year totalled 59.47 inches. May was the wettest month, with 9.44 inches ; February, March, November and December were the driest months, with less than 3.30 inches.

Baraton Veterinary Training Centre (Nandi Native Reserve). Rift Valley Province.

Development.—Much time and labour were put into grazing improvement. The mowing machine was brought into service and despite much anxiety and many breakages, eight paddocks have been brought under control. There is a vast difference between the Baraton grazing and the grazing of the neighbouring reserve, and it has only been by constant and untiring efforts, since Baraton was first started, that the grazing has been brought up to its present standard of excellence.

ANIMAL LIVE STOCK RETURNS

DESCRIPTION	1930	1931	1932	1933
Bulls	1	1	2	2
Cows	32	58	63	64
Heifers (two years old)	—	—	2	9
Steers	—	—	10	14
Heifers (yearlings)	—	9	9	18
Bulls (yearlings)	—	4	—	2
Calves (heifers)	9	9	18	11
Calves (bulls)	4	6	6	13
TOTAL ..	46	87	110	133

Transfers, Deaths, etc.—Sixteen cows were purchased in 1931; one bull in 1932, one cow and one heifer died; six heifers were transferred to cows and ten bull calves and yearlings to steers. One cow died in 1933 and two heifers were transferred to cows; four bull calves to steers; two bull calves to bull yearlings. It is the intention to keep the two yearling bulls, shown in 1933, for future stud purposes.

DETAILS OF MILK PRODUCTION AND DISTRIBUTION AND IN RELATION TO RAINFALL

MONTH	Total Yield	Milk to Staff	Milk to Calves	Milk Separated	Butter made	No. of Cow days	Av. per cow per day	Rainfall
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*		*Lb.*	*Ins.*
January ..	3,728	60	959	2,637	135	628	5·5	2·63
February ..	3,366	77	706	2,513	125	630	5·3	1·78
March ..	3,958	78	380	3,271	221	726	5·4	0·72
April ..	3,853	77	624	2,859	140	716	5·4	3·55
May.. ..	6,006	84	922	4,679	333	889	6·8	8·86
June.. ..	5,984	90	1,057	4,555	326	902	6·6	3·90
July.. ..	5,849	93	1,693	3,870	283	846	6·9	3·23
August ..	5,613	89	1,570	3,742	279	877	6·4	4·66
September ..	4,946	77	1,391	3,348	243	856	5·3	8·14
October ..	5,095	78	1,244	3,402	229	855	5·9	2·64
November ..	5,006	75	1,916	2,843	188	808	6·2	2·64
December ..	3,886	75	1,001	2,648	178	685	5·7	1·02
TOTAL ..	57,290	953	13,463	40,367	2,680	9,472	—	43·82

Summary.

40,367 lb. milk equals 2,680 lb. butter.

15 lb. milk equals 1 lb. butter.

2,680 lb. butter equals 2,010 lb. ghee.

20 lb. milk makes 1 lb. ghee.

10 lb. butter makes 7.5 lb. ghee.

Milk Records.

Year	Total Milk Yield	No. of Cow days	Average Yield per day
	lb.		
1932	45,475	7,440	6.0 lb
1933	57,290	9,472	6.0 lb.

Rainfall.—1931, 67.62 inches; 1932, 50.38 inches; 1933, 43.82 inches.

Examples are given in the following table of Nandi cows showing good milk qualities.

No. of Cow	Lactation	Milk Yield in lb.	No. of Days in Milk	Average butter fat %	Average Daily Yield lb.	Highest Daily Yield lb.
5	1	2,716	322	6.4	8.7	..
	2	3,041	311	6.4	9.8	21.6
	3	2,066	323	5.9	9.0	20.7
10	1	2,648	284	5.8	9.3	..
	2	2,818	280	5.5	10.0	15.6
	3	2,532	250	5.6	10.1	15.3
	4	1,315	83*	4.8	..	17.8
57	1	2,750	329	5.3	8.3	15.1

*Still milking.

TABLE SHOWING MILKING CAPABILITIES OF THE BARATON DAIRY HERD

Below 1,000 lb. in a lactation	1,000–1,500 lb. in a lactation	1,500–2,000 lb. in a lactation	2,000–2,500 lb. in a lactation	Over 2,500 lb. in a lactation
25 cows or 41·1 per cent	11 cows or 8·3 per cent	14 cows or 23·3 per cent	6 cows or 10 per cent	4 cows or 6·6 per cent

Calves.—A total of fifty-three calves was born during the year, twenty-two of which were heifer calves and the rest bull calves. Twenty-one calves were slaughtered for various reasons—unwanted bull calves, and skin disease; eight died of debility. Twenty-four calves have been weaned or are in the process of being weaned.

The average weight of all calves borne in 1933 was 39.2 lb. Bull calves averaged 41.7 lb. and heifers 36.6 lb. The average weights in comparison with former years were : 1931, 41 lb.; 1932, 40.7 lb.; and 1933, 39.2 lb.

EXAMPLES OF CALF WEIGHTS AND GAINS

Number of Cow	Sex	Birth Weight in lb.	Weight at at 26 weeks old	Average Daily Gain in lb.
19	F	41	199	0·87
11	F	33	187	0·84
43	F	33	187	0·84
63	F	32	183	0·83
69	M	30	182	0·83

Calf Herd Average Weight and Gain.

Average gain per day per calf over 26 weeks ...	.75 lb.
Average weight per calf at 26 weeks	172 lb.
1932 average per calf at 26 weeks	183 lb.
1933 average per calf at 26 weeks	172 lb.

An example of the best recorded weight and gain result at the Baraton Centre for 1933 is given below :—

No. of Dam	Sex	Date of Birth	Weight at Birth	Weight on 27–10–33 18 weeks	Average Daily Gain
			Lb.	*Lb.*	*Lb.*
20	M	26–6–33	54	192	1·1

Taking an average gain of 1.1 lb. this calf would scale 254 lb. at 26 weeks.

COMPARISON OF BIRTH WEIGHTS

No. of Cow	Sex	Weight of first calf in lb.	Sex	Weight of second calf in lb.	Sex	Weight of third calf in lb.
3	M	45	M	50	M	43
5	M	40	F	39	M	42
10	F	43	M	46	M	46
20	M	39	F	43	M	54
48	F	37	M	43	M	42

Birth weight averages in comparison with 1932.

WEIGHT IN LB.

YEAR	1st Calf	2nd Calf	3rd Calf
1932.. ..	39·5	41·8	42·7
1933.. ..	33·8	40·0	41·7

The average weight of calves from heifers calving for the first time in 1933 is 33.8 lb., which it will be observed is considerably lower than hitherto recorded at Baraton.

Sales of Farm Produce.—These amounted to Sh. 1,432, which is a decrease of Sh. 218 on last year's total; when the outstanding for December and a certain amount of ghee at present unsold are taken into consideration the total of Sh. 1,650/30 for 1932 would be slightly exceeded.

Disease.—Tests for contagious abortion have been made at varying intervals. The latest report shows one positive and three doubtful cases.

Sterility.—Three of the cows which were allowed free range with a bull on account of sterility have now calved. Number 7 calved previously in 1930 and 1931, missed 1932, and calved on 24-12-33, corresponding to a mating in March. Number 18 calved previously in 1931, missed 1932 and calved twins on 29-11-33, corresponding to a mating in February. Number 23 calved previously in 1931, missed 1932 and calved on 8-9-33, corresponding to a mating in November-December. It would appear from the foregoing that some cows pass through a form of temporary sterility. It may be noted that the matings of three cows took place during December-March, which are as a rule months recording the least rainfall (*see Rainfall*).

Pupils.—Six Elgeyo pupils from the Tambach school were given a one-year practical course in animal husbandry. At the completion of the course in December, 1933, positions on farms were found for these pupils. Ten pupils were signed on in June for the full course and it is proposed to increase the strength to twenty in 1934.

Poultry.—Forty Rhode Island Red cockerels and pullets were distributed among the Nandi, in addition to sittings of purebred eggs.

Isiolo African Veterinary Training Centre. (Northern Frontier District.)

Staff.—One Veterinary Officer and one part-time Stock Inspector.

Breeding Herd.—The experimental herd now numbers as follows: cows and heifers, 83; calves and yearlings, 121; and bulls, 3. The number of calves born was 69, an increase of 7.6 per cent.

BREEDING STOCK

	1929	1930	1931	1932	1933
Bulls	—	—	2	1	3
Cows	—	—	78	75	83
Heifers (two years old) ..	—	—	—	—	17
Heifers (yearlings) ..	—	—	2	12	29
Bulls (yearlings) ..	—	—	—	5	26
Heifer calves	—	—	10	29	35
Bull calves	—	—	5	31	34
TOTAL ..	—	—	97	153	227

Eighteen calves died or were killed during the year.

Calves.—The following weights of calves were recorded. Although the figures on the whole are lower than those of last year, a bigger number of heavier calves is recorded.

COMPARISON OF BIRTH WEIGHTS, 1933

Cow No.	1st Calf	2nd Calf	3rd Calf
	Lb.	*Lb.*	*Lb.*
3	42	39	36
4	41	33	38
11	33	45	42
15	46	40	50
18	44	51	41
24	38	47	47
30	41	41	44
32	36	38	41
44	42	44	45
48	40	36	35
49	31	36	39
56	41	38	46
63	28	43	36

The highest weight recorded for a heifer was 47 lb. and the lowest 35 lb.; for a bull calf, 53 lb. and 37 lb. The highest weight attained by weaning time was 210 lb. and 177 lb. for a bull and a heifer calf respectively. The lowest weaning weight for a bull calf was 95 lb. and for a heifer 94 lb.

MILK RECORDS, 1933

Cow No.	Milk Yield	Number of Completed Days in Milk	Average Butterfat	Average Daily Yield	Highest Daily Yield
	Lb.		*Per cent*	*Lb.*	*Lb.*
1 ..	1,781	235	5·0	7·7	17·6
4 ..	1,756	179	6·0	9·7	13·6
8 ..	1,608	219	5·1	7·3	10·2
18 ..	1,210	117	3·2	10·3	14·1
30 ..	1,185	178	6·0	6·6	9·1
39 ..	1,389	231	7·4	6·0	11·8
63 ..	1,700	191	6·0	9·4	17·1
70 ..	1,839	198	6·4	9·3	15·1
76 ..	1,614	267	4·8	6·1	14·0
82 ..	1,891	241	5·2	7·9	17·2

The highest lactation was Cow No. 31, which yielded 2,182.7 lb. over 297 days' milk yield. The milk yield for the year was 60,865 lb. The highest daily yield for one day was

19.1 lb. (Cow No. 68), an increase this year. Examples of milk yields from six good animals were :—

No. 31	No. 82	No. 70	No. 4	No. 63	No. 14
Lb. 2,220	*Lb.* 1,891	*Lb.* 1,839	*Lb.* 1,756	*Lb.* 1,700	*Lb.* 1,669

The average butter fat content was 5.6 per cent. The average yield per cow per day was 6.5 lb. over 9,427 cow days.

Ghee Production.—1,183.4 lb. ghee were produced during the year. This dairy product was made throughout the year, a notable point, since last year no ghee was produced during practically four months. The experimental work with goat ghee was continued. The total goat milk yield for November and December was 461 lb., giving an average daily yield of .76 lb. The highest daily yield was 1.01 lb. (Goat No. 1). The average fat content was 6.6 per cent. 20.2 lb. of ghee were produced during the months of November and December.

Stock : Native Sheep Breeding Stock.—This flock has remained at Isiolo throughout the year. Comparative birth-weights are as follows : Average for 1932, 5.5 lb. at birth ; for 1933, 5.6 lb.

Rainfall.—The rainfall for the year was 23.21 inches.

African Veterinary Training Centre, Machakos Native Reserve. (Central Province.)

Staff.—One Veterinary Officer, also in charge Machakos and Kitui Native Reserves ; one Stock Inspector.

In the Machakos and Kitui Reserves development of industries arising from animal husbandry has in the past been greatly hampered by the lack of trained boys to help in the work or organization. The Veterinary School has been established to train boys for this work, and even in the short time in which it has been open has supplied twelve trained boys who are now in charge of hide-drying centres in the reserves. Early in 1934 ten more pupils will be passed out from the school and will be in charge of additional hide centres.

From 1934 onwards pupils will be recruited from the Government African School, Machakos, and will require to have passed the Primary School examination. They will be indentured for a period of five years, the first three of which will be spent at the Government African School and the remainder at the Veterinary School. It is proposed to aim at a maximum of fifty pupils per annum, twenty-five going out each year and twenty-five coming in.

For example—

1934—Machakos new pupils	15
Kitui new pupils	10
	25
1935—Machakos pupils from 1934 ...	15
Kitui pupils from 1934	10
Machakos new pupils	15
Kitui new pupils	10
	50

As many as possible of the pupils trained in the school would be employed in the various social centres in the reserves, the remainder being available for work on European-owned stock farms where there is scope for natives trained in animal husbandry. Those of the boys who failed to find employment would return to their reserves but their increased value as private citizens in the reserves would justify the money expended on them.

School Gardens.—An area of land was cleared, stumped and ploughed and to each pupil was allocated a plot of ground for the cultivation and cleaning of which he was held responsible. The gardens were planted up during the November rains with beans, peas, potatoes, tomatoes and maize. These gardens serve the dual purpose of providing practical instruction in agriculture and of supplying fresh vegetables for the pupils.

Trees.—The station has no supplies of timber for construction of rough buildings or for fuel. To provide timber for these purposes in the future, an area was cleared and 5,000 trees (gums, *Grevillea robusta*, macrocarpa, casserina and crotons), were planted.

Cultivation and Grazing.—An area has been stumped, ploughed and planted up with lucerne, sorghum, maize, beans, peas, potatoes, sunflower and New Zealand spinach. All crops are doing well, but in the event of there being no rain in January, 1934, the maize and sorghum will probably die back. Should the rains prove adequate and there be no visitation of locusts, there should be an ample supply of food for cattle and poultry. Five stacks of excellent hay were secured during the year and proved invaluable in the acute shortage of grazing caused by the drought. Excepting in January, February and December, there has been a shortage of grazing which was due to the failure of the March-April rains, a shortage which was reflected in the milk yields.

Poultry.—At the beginning of the year the poultry were found to be in a very unsatisfactory condition. The breeding pens comprised two pens of Black Australorp and three pens of Rhode Island Red, all the birds being old. All diseased and unthrifty birds were destroyed, the remaining young birds being treated with anthelminthics and those which recovered removed to fresh ground. The breeding stock were disposed of and replaced by young healthy birds. One pen of Black Australorp, seven pens of Rhode Island Red and one of Light Sussex now constitute the breeding stock. The reason for increasing the number of Rhode Island Red is that they have been found the most suitable to withstand conditions in the reserve. The practice of rearing chicks with native hens was to a great extent responsible for the heavy worm infestation so it was decided to substitute foster mothers. With the improved methods of management it was possible to rear and issue 314 birds to the Wakamba.

Dairy Herd.—This herd is maintained for the instruction of pupils and also with a view to obtaining reliable statistics for Machakos cattle. The herd was found to be heavily infected with contagious abortion so, in order to eradicate the disease, the entire herd was tested, and all cattle giving positive reactions were cast from the herd. The results were as follows: Total herd, 73; number positive to contagious abortion, 10; percentage infected, 13 per cent. Further tests have been carried out periodically and so far no additional positive cases have been reported. In addition to the ten cows which gave positive reactions to the contagious abortion test, a further eight cows were culled as being unsuitable types. This left a total of only fifty-five cows, which was not considered adequate for the instruction of pupils. Sixteen heifers were purchased and the Machakos cattle at Ngong were transferred to this station. Several cows became temporarily sterile consequent on contagious abortion infection, but practically all the cows are now in calf.

The various causes mentioned above resulted in only a small proportion of the cows being in milk during the year. With few exceptions the milk yields were low, but this must be mainly attributed to the paucity of grazing. Large numbers of cows have had to be cast from the herd during the past two years, mainly owing to contagious abortion, and this has completely disorganized the records so that a fresh start will have to be made.

Rearing of Calves.—The calves are taken away from the dams at birth and are completely hand-fed on whole milk for a period of two months, after which a gradual change over to separated milk is made, the fat which is then absent being replaced by the fat contained in concentrates. Concentrates are supplied in the form of hay, maize meal and bran. High mortality among the calves during the year was chiefly due to East Coast fever infection.

Dipping.—All cattle and sheep have been dipped at three-day intervals. Incidence of East Coast fever has decreased but has not yet ceased completely.

Dairy Products.—Milk, 23,572 lb.; cream, 2,154¼ lb.; butter, 1,240¼ lb.; ghee, 874¼ lb. The average price realized for ghee was Sh. 17/12 per tin of 40 lb. A consignment of two tins of ghee was sent to England as a test with a view to securing new markets. Further consignments have already been asked for by the importers.

Progress.—Definite progress can be recorded for the year, the attitude of the Wakamba being distinctly favourable towards veterinary activities. The work done was greatly facilitated by the helpful co-operation of the other Government departments concerned, special acknowledgement being due to the officers of the Administration and the sanitary inspector who drew plans and prepared estimates for the buildings erected for the veterinary school.

Rainfall.—The rainfall for the year totalled 27.33 inches.

Milk Records of Completed Lactations.

MILK RECORDS OF COMPLETED LACTATIONS

Cow No.	Milk Yield	No. of Days in Milk	Average Butterfat Content	Daily Yield	Highest Daily Yield
	Gallons		*Per cent*	*Lb.*	*Lb.*
38	185·9	289	—	6·43	13·5
15	189·625	278	—	6·32	13·75
70	163·625	250	—	6·54	17·0
93	171·625	223	—	7·69	15·75
60	170·375	254	—	6·7	13·0
9	148·075	217	—	6·82	14·25

The total milk yield for the year 1933 amounted to 3,212.15 gallons over a period of 6,884 cow days, giving an average yield per cow day of 4.66 lb.

CALF WEIGHTS

Cow No.	Sex	Birth Weight	Weight at 26 weeks old	Average daily gain
		Lb.	*Lb.*	*Lb.*
15 ..	F	34	56 at 23 weeks	0·12
60 ..	M	32	92 at 25 weeks	0·34
9 ..	M	36	63 at 20 weeks	0·19
13 ..	M	34	147	0·62

Mariakani Training Centre (Coast Province).

The work at this centre included the following: Demonstration *re* shade-drying of hides and introducing the system into the reserve; production of ghee in the Local Native Council dairies; animal husbandry demonstration and selection of suitable bulls; controlling movement of stock arriving from all over the Coast Province; dealing with outbreaks of disease. Facilities for pupils are not yet available.

DISEASE CONTROL AND DEVELOPMENT.

Although certain services were withdrawn, as the result of retrenchments, the more important services were maintained in the native reserves during the year. There are no services of the Animal Industry Division available in many of the pastoral native reserves. Financial assistance was kindly given to the native services by the Local Native Council, which is acceptable in difficult times, however small the total may be. An immense amount of work has been undertaken by the staff during the year and great credit is due to them for the results obtained under difficult conditions.

Nyanza Province.

Staff—Central and South Kavirondo.—One Veterinary Officer (Maseno); one Stock Instructor (hide preparation); one Stock Inspector (Kibigori quarantine station). *North Kavirondo*—one Veterinary Officer (Sangalo); one Stock Inspector. *Lumbwa*—one Veterinary Officer (part time); one Stock Inspector (part time).

There are two African Veterinary Training Centres in this Province: (1) Maseno, and (2) Sangalo. These centres are discussed under their respective headings. Additional staff was required for the Rabies Campaign.

Central and South Kavirondo Native Reserves.

Rinderpest.—No serious epidemic of this disease took place in the Central Kavirondo Reserve, but numerous sporadic outbreaks were controlled by the serum simultaneous method as shown in the following figures, the inoculations completed at the Maseno Station: 2,344 adults; 2,032 calves at a total of Sh. 7,892. Rinderpest inoculations carried out at the Kibigori Quarantine Station totalled: 1,072 adults; 2,911 calves, at a figure of Sh. 5,591.

Owing to the difficulty in collecting revenue for double inoculations during 1932, it was thought inadvisable to accede to requests from natives for double inoculations during 1933 except in cases where rinderpest was of a virulent nature and causing appreciable mortality. On account of the rigid adherence to this policy, the number of inoculations shows a decrease over that in 1932. During the latter end of 1933, numerous requests were refused for double inoculations, because it would have been impossible to collect the fees before the end of the financial year, as natives wished to be allowed credit till the beginning of 1934. In consequence, a number of stock owners suffered considerable losses from rinderpest, since they had not the necessary cash to enable them to have their stock immunized.

In the South Kavirondo Reserve, control of this disease was not contemplated, because the Stock Inspector in charge was solely employed in eradicating and controlling the rabies menace. In this reserve rinderpest is rife, consequently large numbers of stock succumb daily with considerable loss to the inhabitants in meat and dairy products.

Contagious Bovine Pleuro-Pneumonia.—Central Kavirondo Reserve.—By Proclamation No. 12 of the Official Gazette dated 8th February, 1933, the bovine pleuro-pneumonia quarantine regulations were revoked, after a period ten years in quarantine for this disease. Unfortunately, during the month of May, positive cases were diagnosed in the Kisumu and Sagam locations, when it was necessary to re-apply the quarantine regulations by Proclamation No. 40 dated 31st May, 1933. The whole of the reserve was not quarantined—only that part west of the Kisumu-Kakamega-Eldoret main road. The outbreak was discovered in the boma of a native cattle trader who frequently purchased stock from other reserves bordering on the Central Kavirondo Reserve. In this way, I think, the origin of the outbreak could be traced to such movement of stock from contiguous areas. All affected animals were destroyed, in-contacts branded and 37,757 vacinations were completed in the locations implicated. Towards the end of June, bovine pleuro-pneumonia was discovered in an animal at the Sondu market, South Kavirondo, on the borders of Central Kavirondo and South Kavirondo; consequently it was thought advisable to quarantine the remaining part of Central Kavirondo till full investigations could be carried out, in order to ascertain the pleuro-pneumonia situation in the reserves. Pleuro-pneumonia vaccinations were carried out in the Nyakatch location, when 9,529 head of stock were vaccinated. The outbreaks were under control by August, and by Proclamation No. 70 dated 29th August, 1933, the quarantine was again raised from the Central Kavirondo Reserve.

Assistance was given to the Veterinary Officer, Eldoret, in controlling the outbreak of pleuro-pneumonia which took place in the Nandi Reserve, on the borders of the Kibigori Quarantine Station. Altogether 1,089 vaccinations were completed in the infected area.

South Kavirondo Reserve.—The bovine pleuro-pneumonia regulations were raised from this reserve in the earlier part of the year. Unfortunately, on account of the affected animal found at the Sondu market, it was necessary to re-impose the quarantine regulations by Proclamation No. 51 dated 11th July, 1933. In the Kabondo location 3,412 animals were vaccinated and all stock in the boma from which the affected animal originated were branded and strictly quarantined.

East Coast fever.—This disease remains one of the most serious endemic diseases to be dealt with in the Central and South Kavirondo Reserves. From 60 to 80 per cent mortality of all calves born takes place as the result of the ravages of this disease. No case of East Coast fever was diagnosed or suspected on the Veterinary Training Centre, Maseno, throughout the year. The natives who frequently make periodic visits to the centre have come to realize that it will only be by the eradication of this disease by efficient dipping that they will be able to rear the majority of their young stock and possess calves of good condition and growth.

At the Kibigori Quarantine Station 1,345 head of bullocks and heifers were tested for East Coast fever and branded L.T. This number constitutes a record, since the quarantine was opened, for which Sh. 13,450 was paid into general revenue from receipt of fees.

Trypanosomiasis. — Central Kavirondo Reserve. — The Native Administration of the reserve continued with the clearing of the bush along the lake shore, in the Seme and Kadimu locations. The main object is to make those areas habitable and safe for human beings, by eliminating all tsetse flies, as well as reclaiming large areas of grazing ground which can be safely used for the husbandry of stock, with no fear of their becoming infected with trypanosomes. It is understood that this excellent work is to be continued till such time as all the breeding places of the tsetse are cleared. The advantages accruing from such excellent work are enormous to the native stock owners, by increasing the grazing areas; thereby making it possible for the inhabitants to husband larger numbers of stock and in this way increasing the stock and dairy products of the reserve. The trypanosomiasis quarantine camp, in the North Ugenya location, was in charge of a trained native scout througout the year, who supervised and inoculated 240 head with courses of 4 per cent tartar emetic solution with excellent results.

South Kavirondo Reserve.—No staff being available, nothing could be done to alleviate the prevalence of this disease in a number of areas in this reserve. In the future, when staff is available, this problem will be tackled.

Anthrax and Blackquarter.—Only one outbreak of anthrax and no case of blackquarter was diagnosed during the year. The anthrax outbreak appeared on an Indian farm at Kibos, and was checked by vaccination of all stock on the farm. It is interesting to record that the owner was firmly convinced that malicious injury by his native herd boys was the cause of the mortality. 2,336 blackquarter and 2,286 anthrax vaccinations were carried out in the reserve. Almost all of these were inoculated into stock of the Kisumu and North Gem locations and were issued free of cost to the native stock owners, in order to popularise their efficacy in the control of these diseases and to convince them that their use was attended with immunization of the animals vaccinated for a period of at least twelve months.

Contagious Bovine Abortion.—Throughout the Central and South Kavirondo Reserves this disease causes considerable economic loss to stock owners, in that at least 25 per cent of the female stock abort their first two or three calves, causing a diminution of the calf population and loss of condition and milk supply of the infected cows. The Maseno centre herd was tested monthly and from the results obtained the situation appears to be satisfactory.

Demodectic Mange.—During the year innumerable shade-dried hides have been degraded solely on account of being infected with the parasites of this disease. It is more than difficult for the natives to be able to tell whether a hide is infected or not before slaughter or death, and also very difficult to see the lesions immediately after the animal has been flayed. It is only when the hide has been cleaned, dressed and in the process of drying in the banda for two to four days that the localised lesion shows up and becomes apparent.

A number of dogs with demodectic mange were destroyed during safaris throughout the reserve, and the inhabitants were informed that dogs and goats are the chief vectors in disseminating the disease amongst stock. In those locations where wholesale destruction of dogs had been carried out during the Anti-Rabies Campaign, demodectic mange should be practically negligible in the stock therein.

Other diseases.—Strepthothricosis, distomiasis, etc., and prevalent in the reserves. The latter disease, from observation, is very serious, especially amongst working oxen, and 50 per cent of the livers of animals slaughtered for food were observed to harbour the *Fasciola lanceolatum.*

Rabies.—South Kavirondo Reserve. This reserve was in quarantine for rabies during the year. In comparison with the position last year (1932) it might be said the reserve was practically free of the disease, since only one positive case was discovered on 4th January, 1933, in the Kanyamkago location and two suspicious cases reported from South Mugirango and Suna locations respectively. All locations were rebaited with poisoned baits, in order to ensure there was no possibility of recurrences of the disease. From the distribution of 67,060 baits the following animals were destroyed: dogs, 5,432; hyaenas, 163; jackals, 550; civets, 436; mongoose, 124; leopards, 3; cheetahs, 1. It is seldom, if ever, that one sees a dog in any location, while passing through the reserve, thus it is very unlikely outbreaks of the disease will take place, more especially if the inhabitants do not purchase or obtain other dogs.

Central Kavirondo Reserve.—Throughout the year this reserve was in quarantine for rabies. Only one positive case was diagnosed which was discovered on an Indian farm at Kibos, during the month of September. All carnivora in and around the infected area were destroyed by means of poisoned baits. 30,541 baits were distributed in the East and West

Kano, Nyakatch locations, Kibos-Miwani-Kibigori settled areas, and the Kibigori quarantine station. During this campaign the following animals were destroyed : dogs, 10,672; mongoose, 30; hyaenas, 23; and jackals, 13. The situation is well in hand. It is not expected fresh outbreaks will crop up in this area, because the carnivora therein is negligible. The Kisumu township was also in quarantine during the year. Periodically energetic measures were taken to round up all uncontrolled, stray and ownerless dogs, which were handed over to the police authorities, who instituted proceedings against the transgressors.

Development and Improvement of Cattle and Poultry.

At barazas every opportunity was taken to explain to the native stock owners the advantages accruing from proper methods of animal and poultry husbandry. Greater attention during the year was paid to popularfizing the castration of scrub bulls by the Burdizzo method. Two trained scouts toured throughout the majority of the locations castrating all scrub bulls voluntarily offered by the owners. There is no doubt wherever the Burdizzo method was demonstrated the stock owners were very satisfied and infinitely preferred this method to their old one of crushing the testes to pulp by means of stones and *rungus*. Over 1,500 scrub bulls were castrated in this new manner.

Six hundred and ten pure bred Rhode Island Red cockerels and pullets were issued to the inhabitants of the Central Kavirondo Reserve and paid for by the Local Native Council, Central Kavirondo, from the Sh. 3,000 voted by that Council last year. It is evident the pure bred poultry issued during the last few years have already made a marked improvement amongst the poultry in this reserve. So much so that innumerable birds may now be seen with the Rhode Island Red "stamp" and the eggs offered for sale in the native markets are vastly superior to those presented a few years ago, a number of eggs in fact come up to export quality.

Improvement of Hides and Skins.—The staff in the Central Kavirondo Reserve continued the efforts initiated last year in the furtherance of the policy of encouraging natives by propaganda and demonstration to produce only shade-dried hides of a No. 1 quality. Again, as last year, it is satisfactory to record that a great improvement in the quality and quantity of shade-dried hides was accomplished during 1933 and a return proportionate with the efforts expended can be recorded. The following figures will indicate the progress achieved; shade-dried hides exported by a trading firm during the last five years from the Central Kavirondo Reserve are as follows:—

Years	*Frasilas*	*Years*	*Frasilas*
1929 ...	740	1932 ...	11,016
1930 ...	1,400	1933 ...	18,830
1931 ...	5,000		

As stated in last year's report, the chief drawback to the preparation of good quality shade-dried hides was that the banda roofs, made of grass, eventually became dilapidated, so that rain soaked through causing much damage to the hides therein. From the Sh. 6,000 granted by the Local Native Council, Central Kavirondo, for the erection of permanent hide bandas during 1933, this drawback has been overcome in those places where the new permanent bandas have been erected. A total of nine new permanent bandas were erected in the following markets, where numbers of stock are slaughtered daily for food: Sondu, Kisiani, Yala, Maraboi, Kiboswa, Ng'iya, Kisa, South Gem, Asembo. These bandas vary from 25 ft. to 40 ft. in length, cedar uprights, 9 ft. to 12 ft. diameter corrugated iron roofs, cedar uprights for rails, wire netting sides and sawn cedar doors with wire netting. A few are also surrounded with barbed wire. It is anticipated that these buildings will last for many years with a negligible amount of repairs or expenses in upkeep. It has been noted that green hides dry twice as quickly, and without any detriment to the hides, than was the case in the old badly ventilated grass-roofed ones. All the grass-roofed bandas were kept in a reasonable state of repair and a number of new ones erected with cedar uprights, but grass roofs. These were completed in the Seme (Awach), Alego (one each at Amoth's and Muwer markets respectively) and Sakwa (Abbom). During 1934, from monies voted by the Local Native Council, Central Kavirondo, for additional permanent bandas, the grass roofs will be removed and corrugated iron substituted. All the bandas in the Central Kavirondo Reserve are worked by native *fundis*, who purchase the green hides, bring them to the bandas, where they are dressed, cleaned and dried. The *fundis* are private individuals and are not in the employment of Government, thus it can be said they are hide traders, earning their means of livelihood solely from this trade. As many as six to eight traders worked in the larger type of banda, e.g. Maraboi and Ng'iya. This reserve has the requisite number of bandas for a 100 per cent production of shade-dried hides and it is only a matter of time through propaganda, demonstration and encouragement until this result will be an accomplished fact. At present the majority of the hides produced are shade-dried, it is intended during 1934 to initiate a further campaign for better quality hides. Numerous trestles were erected in the meat markets for hoisting carcasses after slaughter so that flaying could be carried out satisfactorily. In this way native butchers will be prevented from lowering the value of hides by cutting and ruining the hides during flaying, since their old custom was to commence cutting up the carcass before the hide was completely flayed from the beast. It is to be deprecated that thieving of hides increased enormously during the year from all bandas in every location. So much so, that it has in many cases compelled hide traders to prepare hides in their own bomas, since it is hardly to be expected that they will leave them in the bandas, the latter probably a considerable distance from their homes, to be stolen. This is a very serious problem from the departmental point of view, in that inspection is impossible if the majority of the hides are scattered in native bomas throughout the reserve when faults in flaying, dressing, cleaning and drying cannot be pointed out and overcome. A number of "guard huts" were erected alongside the more important bandas as a trial to prevent thefts from these and up to date this method has been entirely successful. During 1934, every banda will possess a "guard hut", when it is hoped all hides in the reserve can be easily and more efficaciously inspected in the recognized bandas. Tours of inspection were constantly made to all bandas and practical instruction given where necessary in flaying and trimming, better washing and cleaning and better stretching. The chief faults noticed were bad flaying, insufficient washing causing stained hides, and too much meat and fat left on in order to obtain a heavier hide. In the South Kavirondo Reserve a start was made in December to improve flaying and preparation of hides and a lecture and demonstration were given at Kisii, at which District Officers, hide traders and butchers were present. Arrangements have been made to build new hide bandas and give instruction in this subject in the new year and it is hoped to improve the local hide industry during 1934.

Estimated production and value of hides, shade and sun-dried, in the Central and South Kavirondo Reserves, 1932 and 1933, are as follows:—

	SHADE DRIED			SUN DRIED		
Central Kavirondo	Frasilas	Rate	Amount	Frasilas	Rate	Amount
		Sh. cts.	*Sh. cts.*		*Sh. cts.*	*Sh. cts.*
1932 ..	15,737	12 50	196,712 50	3,803	7 00	26,621 00
1933 ..	18,830	14 90	280,567 00	5,200	9 70	50,440 00
South Kavirondo						
1932 ..	3,934	12 50	49,175 00	15,203	7 00	106,456 00
1933 ..	6,400	14 90	97,160 00	9,300	9 70	90,210 00

The total number of frasilas in Central Kavirondo for 1932 was 19,540 at a value of Sh. 223,333/50, and for 1933, 27,882 at a value of Sh. 387,283/36; in South Kavirondo, for 1932, 19,142 at a value of Sh. 155,631, and for 1933, 15,700 at Sh. 187,370.

From the above figures it can be seen that a profit of Sh. 133,196 and Sh. 35,080, in the Central and South Kavirondo Reserves respectively, was realized by shade-drying rather than sun-drying. Also, in the Central and South Kavirondo Reserves, by sun-drying instead of shade-drying, the loss was Sh. 30,508/16 and Sh. 48,360 respectively. If all hides in these two reserves were shade-dried their value at present prices would approximately have been Sh. 653,521/52, instead of Sh. 574,653/36 during 1933, a considerable loss of Sh. 78,868/16.

The figures enumerated above show the importance of the hide industry and well merit departmental attention thereto by funds and personnel to supervise and stimulate the inhabitants to produce only good quality shade-dried hides. The Local Native Council, Central Kavirondo, has realized the wonderful asset this industry is to the whole reserve, since they have voted sums of money annually for the erection of permanent bandas. This policy should be continued until such an ideal is reached and the reserve provided fully with bandas of a permanent nature. The vast sum of Sh. 574,653 from only two reserves in the Colony is encouraging to this department and must influence the Local Native Councils of those reserves sufficiently to do all in their power to assist this industry. Appreciable increase in value of all hides produced can be accomplished by improving the quality by demonstration and educating the native butchers and inhabitants to take reasonable care of all green hides and to prepare them properly. Also, such a demand for Kavirondo hides will be created that the best prices will be offered by shippers and agents of the tanners in this country. The number of hide bomas in the Central and North Kavirondo Reserves are as follows: Central Kavirondo, 50, 9 permanent and 41 grass; North Kavirondo, 21, all grass. (These bandas are under the control of Central Kavirondo staff.)

Improvement of quality and quantity of Dairy Products.

Dairy Products.

(*a*) *Ghee Production.*—It has been known for a considerable number of years that the ghee industry in the Central Kavirondo Reserve was of very great economic importance to the inhabitants and if it were to be placed upon a sound permanent business basis a complete organization would be necessary. Since no reliable information of the condition or state of the producing centres was previously available, native personnel were detailed to tour throughout these milk-producing areas, when lists of all dairies, number of frasilas of ghee produced, types of buildings being used, the number of dairy owners in debt and the quality of the ghee being produced were obtained. From the information acquired in this way it was found that the best procedure to adopt for the proper organization of this industry was to ensure that the dairy owners and suppliers would carry out the following simple rules: (1) the dairy owner to possess a milk register in which the supplier's name is recorded and the amount of milk in pint measures recorded daily; (2) the dairy owners to audit their registers and pay out for milk received immediately at the end of the month; (3) the price of 2 cents per pint enamel measure to be the standard price throughout the dairies; (4) the dairy owner to keep all his dairy utensils clean and the suppliers their containers and milk as clean as possible. A number of the dairy owners were found to be heavily in debt, anywhere from Sh. 100 to Sh. 800 each; owing to this fact a large number of suppliers refused to present milk to the dairies since they were still owed money therefrom. A commencement in the organization of the dairies was started in May, in the Seme location, by detailing a veterinary trained boy to persuade the dairy owners to carry out the rules enumerated above. In April and July the

Asembo and Sakwa locations respectively were initiated into the rules of this system. As can be seen from the table below, once our trained scouts had persuaded the dairy owners to carry out the recommendations advocated, an increase in production and improvement in quality was immediately evident, since the milk suppliers knew that they would receive two cents per pint for their milk for which they would be paid with certainty at the end of the month.

Location and Month	Total dairies	Total Ghee tins, produced	Total Suppliers	Cost of Milk	Revenue for Ghee	Profits
				Sh. cts.	*Sh. cts.*	*Sh. cts.*
SEME—						
March ..	10	37½	409	454 58	611 50	156 92
April	14	61	580	770 42	931 50	161 08
May	14	72½	646	883 53	1,036 00	152 47
June	19	94½	802	1,179 13	1,320 00	140 87
July	20	100	855	1,274 04	1,430 00	155 96
August ..	20	107½	902	1,390 39	1,594 50	204 11
September ..	21	116½	981	1,520 71	1,799 00	278 29
October ..	25	143	1,258	1,992 60	2,460 00	467 40
*November ..	22	79	773	1,122 47	1,411 00	238 53
*December ..	19	78	701	1,310 88	1,633 00	322 12
	18½ Av.	889½	790 Av.	11,898 75	14,226 50	2,327 75
ASEMBO—						
April	13	43	647	520 36	662 00	141 64
May	16	91½	837	1,094 70	1,331 12	236 42
June	15	96½	867	1,192 36	1,432 50	240 14
July	16	119½	1,013	1,504 12	1,797 00	292 88
August ..	15	99	922	1,435 92	1,651 00	215 08
September ..	15	120	918	1,621 38	2,005 24	383 86
October ..	18	125	1,049	1,691 26	2,169 50	478 24
November ..	18	112½	1,024	1,591 20	2,032 98	441 78
December ..	18	123½	1,020	1,738 16	2,445 00	706 84
	16 Av.	930½	922 Av.	12,389 46	1,526 34	3,136 88
SAKWA—						
July	15	44	349	511 62	677 00	165 38
August ..	14	49	351	564 84	739 00	174 16
September ..	16	63	430	684 62	989 50	304 88
October ..	16	57½	445	709 08	960 00	250 92
November ..	16	51	449	650 66	827 50	176 84
December ..	16	54½	423	696 94	990 50	203 56
	15½ Av.	319	408 Av.	3,817 76	5,183 50	1,365 74

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* Drop in Ghee production due to cream supplies being sent to the Lumbwa Creamery, *vide* cream supplies.

The system has not reached perfection in such a short period but with perseverance the dairy owners and milk suppliers will eventually be so educated that the system will continue with little or no superivision by departmental staff. Every effort was made and natives encouraged to open up dairies in locations where milk was plentiful for the production of ghee. Since only small funds were available for assistance, it was more than difficult to make progress in this respect, because the expenditure involved in commencing dairies is quite considerable from the native's point of view and it is very difficult to persuade the more educated type of native to risk spending a sum of money for the purchase of the necessary equipment. It is satisfactory to record, however, that efforts met with some success, in that three separators or dairies in the Alego location and one in the South Ugenya location were opened up, locations in which dairies had not previously operated and on the Kano plains twenty-two dairies were operating as compared with only four during 1932. Two ghee or dairy instructors were granted by the Local Native Council, Central Kavirondo, for 1934, when locations such as Uyoma and Kadimu will be supervised and organized as was done for the Seme, Asembo and Sakwa locations during this year. The quality of the ghee exported from Central Kavirondo Reserve is very good and considerable quantities were exported to the surrounding territories, Tanganyika and Uganda.

LOCATION	No. of Dairies	Estimation of output of ghee in lb.	Estimation of Value of ghee produced Sh.	cts.
Seme	25	33,780	15,506	50
Asembo	18	42,420	17,498	25
Sakwa	16	25,520	10,367	00
Uyoma	10	26,880	11,936	00
S. Gem	2	4,800	2,128	00
Kadimu	1	1,920	848	00
Kisumu	1	7,040	3,696	00
Alego	3	12,000	4,800	00
S. Ugenya	1	960	384	00
Nyakatch	22	27,240	12,100	00
E. Kano and W. Kano ..				
Total ..	99	187,560	79,263	75

(*b*) *Cream Production.*—During the month of March the native dairy owners of the Kano plains commenced cream supplies to a creamery. This activity was due to the high price of butterfat: Firsts, 80 cents; seconds, 75 cents; and thirds, 50 cents. When it was realized that the price paid for the cream was stimulating, every dairy owner willing to forward cream to the creamery was helped in every way possible by advice in the way to keep separators and utensils clean and the milk suppliers were persuaded to present only clean milk for cream production. The following table shows the total production of butterfat from the Kano plains only, forwarded to the creamery, with value and grading percentages from March to December.

Butterfat	Value	Percentages, March–December
Lb. 37,850·9	*Sh. cts.* 24,059 70	1sts —49·72 per cent 2nds —34·75 per cent 3rds —15·53 per cent

Even though the price of butterfat dropped to firsts, 55 cents; seconds, 50 cents; and thirds, 33 cents; cream supplies can profitably be forwarded from the native dairies on the Kano plains to the creamery. During the month of October cream supplies from locations west of Kisumu were commenced, as an experiment in order to prove whether supplies could be forwarded successfully to a creamery. Eleven dairies, including the Local Native Council dairy at Kisiani, participated in this enterprise. Daily visits were made to these dairies to advise and instruct owners and suppliers in the proper methods of clean cream production. Efficient transport facilities were organized successfully and everything that could have been done to persuade the dairy owners and suppliers to produce good grade cream was accomplished. Notwithstanding all efforts, the quality of the cream on arrival at the creamery did not come up to expectations; even though that from Kisiani was of infinitely better grade than that from the other ten dairies.

	Butterfat	Value	Grading percentages
	Lb.	*Sh. cts.*	
October to December, 1933	10,162·9	4,485 40	1sts —17·36% 2nds—19·31% 3rds—63·33%

Total amount of butterfat, value and grading percentages of all cream from the Central Kavirondo Reserve, 1933, forwarded to the creamery: 48,013.8 lb. butterfat; value: Sh. 28,545/10. Grading percentages: Firsts, 52.87 per cent; seconds, 31.48 per cent; thirds, 25.65 per cent.

Total value of cream and ghee production from Central Kavirondo Reserve during 1933 : Sh. 107,808/85.

Establishment of Subsidiary Training and Marketing Centres.—The two centres started last year at Kaluo and Ahero, in the Alego and East Kano locations respectively, were supervised and found to be working satisfactorily throughout the year. The dairies produced 400-480 lb. of ghee monthly, thus enabling the natives in their vicinity to sell their milk and in this way they obtained cash to pay their taxes and purchase necessities, e.g. food and clothing. At the commencement these dairies were financed and operated by the department, but they have now been handed over to reliable natives, trained in ghee production, who are making a reasonable profit monthly under supervision. The hide bandas were kept in repair and all hides therefrom were prepared satisfactorily. The butcher shops were kept in a clean condition, and the meat stored in the safes free from flies and other contamination.

A number of natives in the vicinity of these centres were trained at the centres in ghee production, shade-drying of hides and butcher work. Upon completion of their training they commenced such work for themselves in their own locations. The influence of these centres upon the natives in the vicinity in the dairy and hide industries is shown by the fact that in the Alego and Kano locations new dairies numbering three and twenty respectively were opened during the year. Also a keener interest in the preparation of hides was evinced. Each of these centres was in charge of a trained veterinary scout, who supervised and helped in all the activities taking place throughout the year.

A new subsidiary training and marketing centre was started during the year which was erected at Rabuor in the West Kano location. A dairy, hide banda, butcher's shop and crush were completed, thus the inhabitants in the vicinity can obtain cash for their surplus milk; meat may be purchased in a clean condition; their green hides prepared in a manner attaining the top price and their stock immunized against disease.

Improvement and Supervision of Markets.—The present state of the markets throughout the Central Kavirondo Reserve is by no means satisfactory, and it has been for a considerable time one of the aims of the department to endeavour to improve this position. As far as stock products are concerned improvement has already been commenced in a small way by the erection of permanent hide bandas, butchers' shops and dairies in the principal or main markets in the reserve. All these buildings have been erected in such a way that they border on the market, forming a square or rectangle in which the natives sell their produce. As already stated nine corrugated iron-roofed hide bandas were erected in the markets and also two new butchers' shops, one at Yala and the other at Kiboswa, in the North Gem and Kisumu locations respectively, making four permanent butchers' shops in all. These shops possess a meat safe in which the meat can be stored in a clean condition free from flies. A number of butchers in the smaller markets were helped in building grass-roofed butchers' shops with corrugated iron tables upon which the meat is placed for sale and the tables can be easily cleaned as necessary. Trestles for the hoisting of stock after slaughter were erected at a number of markets with the object of producing cleaner meat and thus preventing the carcass from contamination with manure, etc., if left on the ground, as is the usual custom. Pits were dug outside the various markets for the reception of all market refuse, e.g. bones, pieces of hides, maize cobs, etc. Endeavours were made to keep the markets as clean as possible by sweeping as often as possible. If the markets were the property of the Local Native Councils, all the fees accruing from them could be left in a fund and when a sufficient amount had accumulated, each market in turn could be supplied with permanent buildings; the latter to be let out to reliable traders.

Facilitating the Movement of Stock to and from the Reserves.

Central Kavirondo Reserve.—This reserve having been in quarantine for bovine pleuro-pneumonia for only a few months of the year an increase in the export of stock via Kibigori Quarantine Station is recorded. Over 2,000 head were exported at a value estimated at Sh. 90,000. The activity on the goldfields in the North Kavirondo Reserve stimulated traders in the Central Kavirondo Reserve to export large numbers of slaughter stock for the meat rations of the native labour working on the goldfields. As a conservative estimate 300-500 head were exported weekly. The number of stock and value exported from the Central Kavirondo Reserve to Uganda via the Lake steamers for 1932, as compared with 1933 :—

In 1932 : 2,950 head valued at Sh. 177,000.

In 1933 : 1,374 head valued at Sh. 82,440.

The figures for 1933 show a decrease and it is believed that the main reason for this was that quarantine regulations were revoked from a number of locations in the Uganda Protectorate, so that these locations were able to supply the meat requirements of their main towns, e.g. Kampala and Jinja. Permits were issued from the Kibigori Quarantine Station for the movement of 11,630 sheep and goats from the Central Kavirondo Reserve to outside districts. This number shows a decrease of 4,049 over the previous year's exodus.

South Kavirondo Reserve.—In order to facilitate the movement of stock from this reserve during the year a new quarantine station was erected at Ongongo, in the Mumbo location. The District Commissioner, South Kavirondo, kindly helped by granting labour and timber for the erection of the Stock Inspector's house, kitchen, boys' quarters, office, garage, store, hide banda, dairy and crush. The doors, windows and cement, etc., were granted out of departmental funds. From 19th September to the end of the year, 3,344 head of cattle were quarantined, branded "V.S." on the forehead and passed through to the Central Kavirondo Reserve. These consisted of bullocks, bulls and a few barren cows and heifers.

General.—At the Royal Agricultural and Horticultural Society's Show held at Nairobi on the 28th and 30th December, 1933, the following prizes were won for native exhibits : Section P—Native Industries—Sub-section C—Composite Exhibits No. 25 ; Natives Working at any Native Industry : Second prize, Working Dairy in Reserve ; and a Highly Commended, Working hide banda in Reserve. In each of these working exhibits two Maseno Training Centre pupils were in charge. It augurs well for the future that at the first attempt a second prize and a highly commended were won.

Section P—Native Industries—Sub-section A—Indigenous Industries No. 7 : 1st, 2nd and 3rd prize, Shade-dried hides ; highly commended, 3 jars of ghee and 3 bundles of sisal rope.

Sub-division B—Industries developed under European guidance No. 23 : 1st and 3rd prize, Shade-dried hides, and Highly Commended, 2 tins of ghee.

Section O—Native Agriculture—Animal Products No. 32 : 3rd prize, Shade-dried hide. In this section, open to all Kenya, the North Kavirondo Reserve won 1st and 2nd prizes, and the Central Kavirondo Reserve the 3rd prize.

CENTRAL KAVIRONDO RESERVE—INOCULATIONS, 1933

Station	Rinderpest Inoculations						P.P. Vaccinations	Black-quarter Vaccinations	Anthrax Vaccinations	E.C.F. Tests	Mortality	Revenue Collected
	Adults			Calves								
	Native	Farm	Trade	Native	Farm	Trade						
												Sh. cts.
Maseno	2,344	—	—	2,032	—	—	37,757	2,336	2,236	—	129	8,797 40
Kibigori	1,072	826	2,149	2,911	128	52	14,225	—	—	1,345	157	25,702 00
Total ..	3,416	826	2,149	4,943	128	52	51,982	2,336	2,236	1,345	286	34,499 40

DETAILS OF DOUBLE INOCULATIONS CARRIED OUT DURING THE LAST SIX YEARS IN CENTRAL KAVIRONDO RESERVE

Station	1928	1929	1930	1931	1932	1933
Maseno	14,262	27,552	23,698	18,536	13,125	4,376
Kibigori	16,513	7,808	14,903	3,657	4,181	7,231
Total ..	30,775	35,360	38,601	22,193	17,306	11,607

North Kavirondo Reserve.

Rinderpest.—At the beginning of the year a serious outbreak occurred in North Kitosh. It appears to have originated in the Kimilili district and to have spread thence to Malakisi, Waanga, Buhayo and Marach. The freedom of Sudi's district, which adjoins the infected district, must be attributed to the fact that the majority of cattle are immune as the result of double inoculations carried out there last year. The outbreak which occurred later in the year in Rapando's location originated in Waanga. A third outbreak occurred in East Kakamega on the boundary of the reserve. The original outbreak in North Kitosh was controlled by double inoculation, many thousands of cattle being immunized in this way. Later in the year the native was unable to pay for inoculations and accordingly quarantine measures were adopted. This method, even when no active immunization is carried out, is very effective in preventing the spread of disease. Great assistance can be obtained from chiefs and headmen in maintaining and policing such quarantines. This help is imperative in these days of shortage of native personnel. The quarantines imposed in North Kavirondo were in force for four to six weeks on the average, depending on the size of the area involved. That quarantine measures alone are an effective means of eradicating the disease is seen from the outbreaks in East Kakamega and Rapando's which were terminated within three months. As a result of the measures employed to control rinderpest North Kavirondo is now free from this disease, except for one small area in Waanga which has been quarantined for the last few months.

The problem of keeping North Kavirondo free of rinderpest is not an impossible nor even a difficult one. There is no danger of infection being introduced from the north side, bounded by Elgon, nor from the west bounded by Uganda. There only remain the east and south boundaries and prompt attention to outbreaks occurring in locations on these boundaries should prove effective in keeping the remainder of the reserve free from rinderpest.

Double inoculations for rinderpest performed during the year were: Adults, 14,251; calves, 1,286; total of 15,537; which gave revenue of Sh. 36,913/50. The comparison with previous years is given below:—

	1930	1931	1932	1933
Double inoculations ...	14,903	3,657	16,653	15,537

Rabies.—A positive case occurred in a bull terrier, owned by a European in the Kakamega district, on the 18th August.

The dog had been obviously ill for a week and the owner, suspecting rabies, brought it to the Police Camp where it was destroyed. The brain was despatched to the Laboratory and positive notification of rabies was received on 30th August. Subsequent to this outbreak an area of North Kavirondo, defined in Proclamation No. 75 of the Official Gazette dated 19th September, 1933, was placed in quarantine. The baiting of stray dogs within this area was carried out and resulted in the death of approximately one hundred dogs, that is about 10 per cent of the total dog population. A census of dogs in the rabies quarantine area was taken and totalled 989 dogs, including 63 European-owned and 926 native-owned.

When attending barazas in connection with this outbreak the interesting fact emerged that rabies was known in Marama's and the Kisa locations about thirty to forty years ago, since when it has been absent. The native recognized the deadly nature of this disease and killed or drove away infected dogs. No further cases have occurred since the original outbreak. It was impossible to trace the source of the infection in this case. The probability is that the bull terrier came into contact with an infected wild carnivore or native dog.

East Coast fever.—This disease is responsible for a considerable mortality among calves in the reserve. Although it has not yet been possible to institute dipping at the Sangalo Training Centre, the improvement of pastures by ploughing and planting, fencing and hand de-ticking of calves has effected a considerable reduction in the mortality from this disease, a fact recognized by the native. There is some evidence that this disease is spreading in the Marach location.

Trypanosomiasis.—In the south-west part of Marach around the Samia Hills this disease is a serious problem. A comparatively wide stretch of country is devoid of cattle.

Contagious abortion.—The economic loss ensuing from this condition, through abortion, loss of milk and sterility, is considerable.

Demodectic mange.—This disease is responsible for a considerable diminution in the value of hides.

Calf mortality.—The main cause of calf mortality is East Coast fever. Other causes which have come under notice are intestinal diseases and pneumonia.

Development—Improvement of Cattle.—The improvement of cattle in the reserve is still in its early stages. The potentialities of the North Kavirondo cattle are being enquired into at the Sangalo African Training Centre. It is now evident that a small percentage of animals possess distinct milking capabilities and it is by breeding from such animals that good bulls will be obtained, which when issued to the reserve will eventually prove of great service in raising the milking standard generally.

Considerable progress has been made this year in the castration of scrub bulls by the Burdizzo method. At first the native was rather doubtful about the worth of the method but he is now realizing its effectiveness and is bringing forward more cattle to be operated upon. Native scouts have been trained in the use of the Budizzo and now do castrations along with their other district duties. Over a thousand animals have been dealt with since August.

Improvement in Quality and Increase in Quantity of Dairy Products.

Thirteen field dairies were in operation at the end of the year. Another dairy was built but had not commenced work. The price of ghee was low and so accordingly was the price paid to the native for cream. This market price kept the production low as the native prefers to keep his cream rather than sell it at a low figure. Towards the end of the year the price of ghee rose, enabling a better price to be paid for cream and this was reflected in the increased attendance at the dairies.

Comparison with price per frasila of ghee in previous years shows: Sh. 26 in 1931; Sh. 22 in 1932 and Sh. 17 in 1933.

Sale of Milk at Field Dairies.

	lb.
Waanga I	84,453
Waanga II	184,243
Kabjai	118,437
Sangalo	106,441
Kibabi	219,935
Ndakalu	138,199
Malakisi	126,085
Buhayo	49,541
Buhayo Bubengi	7,252
Marach	82,312
Wamia	52,199
Kabras	16,450
Kimilili	18,093
Total ...	1,203,640

May and June are the months in which milk is most plentiful. The milk brought to these dairies is separated, the separated milk returned to the native and the cream is either sold as such or is made into ghee. During the year 39,318 lb. of cream and 968 frasilas of ghee were sold.

YEAR	Milk Sold	Cream Production	Value	Ghee Production	Value	Total Value of Dairy Products
	Lb.	*Lb.*	*Sh.*	*Frasilas*	*Sh.*	*Sh.*
1931..	445,000	—	—	516	13,416	13,416
1932..	442,045	8,207	2,050	514	11,308	13,265
1933..	1,203,640	39,318	9,829	968	16,940	26,769

Benefit to natives in the following locations from the sale of dairy products resulted :—

	Sh.	*cts.*
Sudi's	6,386	93
Malakisi	4,251	91
Waanga	3,705	32
Marach	1,128	80
Buhayo	788	30
Wamia	788	08
Kimilili	261	67
Kabras	201	94
	Sh. 17,512	95

To this figure must be added wages, cost of transport, etc., viz. Sh. 4,445/86. The total benefit to the native is therefore Sh. 21,958/81.

The above figures refer solely to Local Native Council dairies. It is evident that a considerable profit accrues to the native from the sale of dairy products. This profit should become very much greater in the near future as the number of field dairies increases and if a better price is paid for cream as should transpire if all the cream can be disposed of to a creamery. In addition to the ghee produced by these dairies, there is a small output from Indians operating in townships. Cream from Local Native Council dairies is sold to a European who is working a dairy at Malakisi's. This European also buys cream from natives and makes it into a good quality butter. Two boys in charge of field dairies at Waanga II and at Kibabi gained first and second prizes respectively in the open ghee competition at the Royal Agricultural and Horticultural Society's Show held in Nairobi in December.

Hides and Skins.—The hide industry in the North Kavirondo Reserve has made considerable progress during the year. The value of North Kavirondo hides for the last two years is as follows :—

	1932	1933
Sun-dried	64,694 ...	64,509
Shade-dried ...	20,556 ...	129,282
	Sh. 95,250	193,791

The great increase in the value of hides is due to (*a*) increase in the shade-drying of hides, (*b*) better preparation of hides, (*c*) increase in the number of stock slaughtered, particularly in the Kakamega district, and (*d*) increase in the market value of hides. Twenty-two new hide bandas were erected in the district during the year, which makes a total of forty-nine in operation. There are still quite a number of sun-dried hides produced in the reserve but these are decreasing every year. The past year has been a particularly favourable one for hides on account of the excellent prices obtained. Intensive propaganda at barazas and throughout the reserve has done much to stimulate the shade-drying of hides. Native scouts stationed in the reserve have been continuously employed in demonstrating the proper methods of flaying, trimming and preparing hides. It is of interest to record that two North Kavirondo boys, one from Marach and the other from Sudi's, gained first and second prizes for hides in the open hide competition at the Royal Agricultural and Horticultural Society's Show in Nairobi in December.

Native Markets.—Native markets are usually in a very filthy state with debris scattered all over the ground in the vicinity. Buildings, such as they are, are put up without any idea of order. An attempt has been made to reduce these markets to some sort of order. They have been laid out in the form of a square with one side bordering a road. Hide bandas have been built at all the principal markets and field dairies where the cattle population permits. Butcher's shops conforming to a standard type have been built and in addition slaughter places and offal pits have been provided. At two big markets it was possible to equip these slaughter places with cement floors. In the more northerly locations markets are small and unimportant. Cattle are slaughtered under trees all over the country. The provision of markets with the above facilities helps to concentrate all the marketing activities in the one place. As a result markets are much more easily inspected, trade is fostered and cattle can be slaughtered under more hygienic conditions. Hides can be cleaned and prepared under good conditions and dried without delay. Where such facilities exist it has been insisted that cattle be slaughtered in markets. This procedure has been attended with a considerable measure of success.

The following movement of stock out of the reserve has taken place in the last two years :—

	1932	1933
Purchased by Europeans ...	866 ...	777
Under traders' licences ...	538 ...	154
Squatters	527 ...	779
	1,931	1,710

The Local Native Council has kindly provided funds for the following purposes : Expenses of pupils at the Training Centre, Sh. 2,160; native staff, Sh. 1,560; six permanent hide bandas, Sh. 2,364; four field dairies, Sh. 2,520; poultry, Sh. 1,260; making a total of Sh. 9,864 for the ensuing year.

Lumbwa Native Reserve.—During 1933, owing to the outbreak of rabies in South Lumbwa, the district staff was for the major part of the year engaged in the Rabies Suppression Campaign, assisted by special staff seconded for the purpose.

Disease Control. Bovine Pleuro-pneumonia.—In conjunction with rabies work, a survey of the reserve had been made with regard to pleuro-pneumonia and as no active cases of the disease could be traced, it was decided that the reserve had become free from pleuro-pneumonia and the quarantine was removed on March 29th, 1933. Towards the end of the year, suspicions existed that the disease had been re-introduced in the Sotik Reserve from the adjoining Masai Reserve, but these, however, were not confirmed until the following year.

Rinderpest.—Rinderpest is always present in one part or other of the reserve, and should be looked upon as one permanent outbreak. In June, double inoculations for rinderpest were tried both at Kipterre and Kericho, but with a poor response in each case. Shortage of money was partly responsible, but as no inoculations had been carried out on a large scale for some considerable time in the reserve, owing to rabies control requiring all the available staff, the natives were inclined to be very suspicious, and were evidently anxious to test the double inoculation method again with only a few stock, before deciding to risk the balance of their cattle. As at that time difficulty was being experienced in the collection of taxes, it was decided to postpone further inoculations until the taxes had been paid. In December the campaign was resumed and met with a very much better response in the numbers which attended, evidently the previous suspicions had been overcome, partly by the good results obtained from the earlier inoculations, but chiefly from the experience gained by the squatters in the farm inoculations in the settled areas. If the amount of anti-rinderpest serum available had not been limited, more inoculations could have been carried out. In every instance, spleen virus, despatched in ice-chests from the Veterinary Research Laboratory, was used and the reactions appeared to be most satisfactory, but as previously mentioned, rinderpest being always present in the reserve, a fairly large percentage of the cattle were already immune. It is also quite impossible to obtain reliable figures of the mortality which resulted, but the general satisfaction expressed by the natives indicated that they were not high. The Lumbwa, like certain other tribes who have no desire to sell stock, rarely submit their cattle for the A.M. brand after the inoculations. The number of cattle which was treated belonging to the natives in the reserve was 1,197 adult cattle and 882 calves, producing a revenue of Sh. 3,874/50 in inoculation fees.

Development—Hides.—Four bandas were in operation for the shade-drying of hides, one at Kericho, which treated about 95 per cent of the hides, and the other three being in the charge of chiefs of different locations. It is gratifying to be able to record that there was quite an increase in the number of hides brought to these centres as compared with previous years. Prior to 1932, no shade-dried hides were exported from the reserve. The number of hides treated in 1932 amounted to 576, weighing 8,503 lb. and valued at Sh. 2,655/63; in comparison, the number treated in 1933 amounted to 1,374, weighing 21,947 lb. and valued at Sh. 8,569/81.

General.—It is a pity that no progress could be made in the Lumbwa Reserve for starting a centre to demonstrate to the natives the advantages derived from improved methods in animal husbandry. Even the proposal of starting a place where surplus milk could be brought and separated for the manufacture of ghee or disposal to a creamery was viewed with disfavour.

The Lumbwa native has been blessed with a very fertile reserve with an abundant rainfall, which, even in times of drought experienced elsewhere in the Colony, does not seriously affect them. In spite of this, the reserve is rapidly deteriorating from mismanagement. Already in parts of Belgut the land shows signs of over-grazing and soil erosion is taking place; Buret, which once consisted of forests, with open glades of elephant grass, has now become for the most part dense bush, where only the ubiquitous but useless goats can thrive.

The amount of revenue obtained for veterinary services in the Lumbwa Reserve, including a small amount collected from European farms in South Lumbwa not excluding the Sotik farm inoculations, was Sh. 4,602/50.

Rift Valley Province.

(Nandi, Elgeyo, Marakwet and West Suk Native Reserves.)

Staff.—One Veterinary Officer part time, one Stock Instructor, Baraton. There is an African Veterinary Training Centre at Baraton for the Province.

Nandi.—The Baraton Training Centre continued to maintain progress and several new buildings of a permanent nature were erected. Grazing improvement was concentrated on, and in spite of the low rainfall for the year good results were obtained. The station is now in a position to deal with pupils and some have already been passed out and placed in work.

4,555 cattle and 2,440 sheep and goats were exported from the Nandi Native Reserve during the last six months of the year.

Disease Control. Rabies.—This disease appeared in October, 1933, in several centres though only two positive cases were diagnosed. Extensive poison baiting was carried out and a noticeable feature in connection with the control of this disease was the response of the natives by bringing in jackal tails for a payment of Sh. 1 per tail.

Bovine Pleuro-pneumonia.—Extensive vaccination was continued as in 1932 and some 50,000 head of cattle were dealt with. The quarantine restrictions were removed in June, 1933.

Rinderpest.—Rinderpest inoculations were carried out in the centre of Maraba, Koyo and Baraton. Rinderpest persisted throughout the year. Figures for double inoculations and revenue in comparison with previous years are as follows: 1930, 5,434 head immunized, revenue Sh. 13,134; 1931, 12,585 head immunized, revenue Sh. 27,727; 1932, 13,558 head revenue Sh. 30,490/50; and 1933, 9,209 head, revenue Sh. 16,601/50.

Blackquarter.—This disease was reported from several sources, and vaccinations were carried out to a small extent chiefly among Government-owned stock and cattle belonging to veterinary scouts.

General.—It should be stated that the time devoted to disease-control work is considerable in addition to the growing volume of work involved by the activities of the training centre and in consequence development work could not be initiated as desired.

Elgeyo-Marakwet.—No staff is available for work in these reserves but the natives are afforded an opportunity annually of having their stock immunized against rinderpest at two centres, i.e. Sergoit and Chebororwa. At Sergoit some 3,242 head of cattle were dealt with and at Chebororwa some 319 head. This assistance enables a number of immune bullocks to be exported for auction and thus helps to provide money for the tax collections, etc. A further inoculation was carried out at Timboroa in December and 776 head were dealt with.

West Suk.—A stock inspector was stationed on the borders to facilitate the export of Suk stock from the reserve. Safaris were made in the reserve with a view to obtaining information as to what diseases existed. The results were not very successful. With the exception of East Coast fever no active disease was found in the stock. Several cases of tuberculosis were found in 1932 in stock exported from Suk and it would be interesting to know the incidence of this disease in humans in that area. Owing to the strong representations of the Administration every effort was made to improve conditions for export of stock and arrangements were made for export of breeding and transport stock as well as slaughter stock to local markets after inspection. The results were not encouraging and actually no breeding stock was forthcoming; neither are Suk stock popular for transport purposes owing to their susceptibility to East Coast fever. Many well-known farmers learnt a lesson in this respect in earlier days and have apparently passed the information along. The Stock Inspector was withdrawn from this reserve in June and the Stock Inspector at Kitale has since continued to do the work where necessary. As a result of the efforts to foster export of stock from this area nearly three hundred head of cattle were exported during the year.

Rinderpest inoculations were carried out in the Province as under:—

	Adults	*Calves*
Nandi	6,354	2,763
Elgeyo and Marakwet—		
Sergoit	2,973	235
Timboroa	675	101
Chebororwa	254	5
Ndorobo Timboroa ...	2,177	337
Kamasia Timboroa ...	1,188	239
	13,621	3,680

(Uasin Gishu Masai, Kamasia, Njemps and East Suk Native Reserves.)

Disease Control.—An outbreak of bovine pleuro-pneumonia occurred in the East Suk Reserve.

An outbreak of rinderpest in the Lembus section of the Kamasia Reserve is being dealt with by the rinderpest service. Figures are not available as yet, and will be sent in by the Stock Inspector in charge of the inoculations. In the absence of general inoculation facilities for the Kamasia and Uasin Gishu Reserves, an area of land about one square mile in extent was marked out near the Lower Molo Trading Centre. Into this area all find cattle are taken, and after an observation period of a month are taken to Rongai and sold by auction. The guards are provided by the District Commissioner, Baringo, and so far the method seems to act quite well. In any case it is the only reasonable solution of dealing with the flow of cattle from the reserves to meet the demands of trade and hut tax, in the absence of other facilities.

No staff was stationed in these reserves but the Veterinary Officer at Nakuru is in control.

Central Province.

(*Machakos, Kitui Native Reserves.*)

Staff.—One Veterinary Officer (part time), one Stock Inspector. There is one African Training Centre in the Province at Machakos.

Disease Control—Rinderpest.—This disease is widespread throughout the reserve and causes a heavy mortality amongst the young susceptible stock. This state of affairs is undesirable as the young stock should form the breeding herds. Owing to the inability of the majority of the stock owners to pay inoculation fees, little could be done to eradicate rinderpest.

East Coast fever.—This disease is endemic.

Trypanosomiasis.—The south-eastern part of the reserve, which includes approximately one-eighth of the whole reserve, is "fly" country. There are practically no cattle in this area, which is inhabited by game. An experiment is being made in this part of the reserve with cotton-growing which, if it is successful, will ensure the clearing of the bush and thus, eventually, the extirpation of the flies which transmit the disease.

Development.—During the last two years the Akamba tribe has come to realize that they must rely more on the sale of agricultural and stock produce than on the money brought into the reserves by the young men who work on farms, etc. Despite this realization they cannot bring themselves to restrict the numbers of their stock with a view to improving quality, chiefly because the number of stock owned is still the criterion of wealth. In all schemes for the benefit of the tribe the Local Native Council has shown keenness to co-operate and have given financial assistance to help them.

Machakos Reserve.

Grazing.—Owing to the comparative failure of the March rains there was an acute shortage of grass throughout the year. During August and September a heavy mortality due to starvation occurred amongst stock. Eventually practically all the stock from the locations bordering the Athi River had to be moved to the Yatta Plains for grazing.

Water.—The reserve is well supplied with water by rivers and dams. Many of the rivers appear to be dry, but water can always be obtained by digging a few inches below the surface of the sand.

Overstocking.—The reserve is grossly overstocked but there appears to be no way of remedying this difficulty at present as there is no market for the type of animal which should be culled. Still, much could be done towards preservation of what grazing there is by limiting the number of goats.

Development—Hides.—Previous to this year only sun-dried hides were exported from the reserve. The market value of these types as compared with that of shade-dried is approximately one-third, so the advantage of encouraging the Wakamba to shade-dry hides was obvious. Hide-drying plants were erected at the following places: Machakos (two sheds), Kani, Masii, Seathani, Mbuni, Kangundu, Tala, Mitaboni. These centres were staffed by boys trained at the African Training Centre, Machakos, and are being fairly well supported with the exception of Kani, Masii, Seathani and Mitaboni. No funds were available to erect a hide-drying plant at Kyabaluki and therefore it was not practicable to enforce the Hides and Skins Rules of Government Notice No. 432 of 1932, but a hide shed will be erected in this district early in 1934, a road of access having been already surveyed and a site chosen.

Shade-drying of hides was commenced in the reserve in the month of July and since then 408 frasilas of hides have been prepared. The average price realized for sun-dried hides is 10 cents per pound, whereas prices obtained for shade-dried hides are 40 cents per pound at Machakos and 33 cents per pound in the reserve. Shade-drying of hides has thus benefited the Wakamba to the extent of Sh. 3,379 more than would have been realized for sun-dried. The results to date must be considered satisfactory as the industry is new to the Machakos Reserve and has only been in existence for six months.

The foregoing facts indicate the financial benefits which will result from this service when it is established throughout the reserve. In the Local Native Council estimates provision has been made for the erection of ten new hide sheds during 1934.

Poultry.—Every year the Wakamba send large numbers of poultry to Nairobi for sale. These birds are of native type and are of little value for table purposes, with the result that the prices obtained are very low. With a view to benefiting both the seller and purchaser, pure bred birds are being supplied to the natives in order to improve the quality of the poultry. Wtih this aim in view, i.e. the production of a good quality table bird, Rhode Island Red, Black Australorp and Light Sussex types of poultry are being issued. During the year 314 pure bred birds were supplied from the breeding pens at the Machakos Training Centre.

In rearing poultry for issue care is taken to feed them on a ration as near as possible to that which they will receive in the reserve.

In addition to the poultry farm at the Machakos Training Centre, six subsidiary centres were built and stocked at the undermentioned village schools: Kani, Masii, Seathani, Kangundu, Matungulu, Mitaboni. Pupils attending these schools are given practical instruction in poultry-keeping, and the surplus birds are issued to them free of charge.

Ghee.—On account of the drought there has been no surplus milk and therefore nothing could be done towards increased and improved ghee production. In this reserve the ghee trade has been completely ruined by unscrupulous traders who adulterated the original good quality ghee with simsim oil, so that what little Machakos ghee there now is has a very low market value.

General—Movement of Stock.—The number of stock moved out of the Machakos Reserve on permit was 6,080 cattle and 48,071 sheep and goats. The major portion of these was moved when the natives had to sell stock in order to obtain their tax money.

Illicit movement of stock has been responsible for much spreading of animal disease. The trespass of Masai cattle on the mile zone continues to constitute a grave menace to this reserve as pleuro-pneumonia is always liable to be contracted in this area.

Kitui Reserve.—It has only been possible to carry out one safari in this reserve owing to its distance from Machakos and for other reasons.

Disease Control—Rinderpest.—At the beginning of the year the reserve was free from rinderpest but in March infection spread from the Meru Reserve and thus the northern locations had to be quarantined. These quarantines were imposed by the District Commissioner and met with such success that it was possible to revoke them in June. The reserve remained free from the disease until November, when infection was re-introduced by Galla stock trespassing on Crown land on the eastern boundary and by Machakos stock on the Yatta Plains. Both areas were quarantined by the District Commissioner and spread of infection appears to have died out.

East Coast fever.—With the exception of the four Kitui locations the whole of the reserve is free from East Coast fever infection.

Trypanosomiasis.—There are numerous ''fly'' belts in the eastern and southern areas of the reserve but it should be possible to clear these up at moderate expense should additional grazing be required.

Development—Hides.—The hides in this reserve are of better quality than those of Machakos. This difference can be accounted for by the absence of tick-borne infections which are responsible for the small stunted cattle in the Machakos Reserve. Rapid progress has been made in shade-drying of hides which has been organized by the District Commissioner. The natives in charge of the various centres were trained at the Training Centre, Machakos.

Ghee.—Large quantities of ghee are made in the reserve but the quality could be greatly improved. With this end in view Kitui natives are being trained in ghee manufacture at the Training Centre, Machakos.

Masai District.

Staff.—Ngong, one Veterinary Officer and one instructor in stock; Kajiado, one Veterinary Officer and one Stock Inspector.

There is a Training Centre at Ngong for the benefit of the Masai tribesmen.

It was not possible to maintain the former staff in the Province during the year owing to the necessity for special staff on the Rabies Campaign and for other reasons. Thus little attention was devoted to the Narok and Ngong districts. The more important services in the Kajiado district were, however, maintained.

Disease Control—Rinderpest.—As in 1931 and 1932 one dose of field prepared vaccine was used to confer a temporary immunity on susceptible stock exposed to infection, but in July this method was superseded with the adoption of the vaccine-virus method of immunization, since when supplies have been obtained from the Laboratory, payment being made in kind.

During 1932 the number of outbreaks of this disease reported and dealt with was twenty-four, in which thirty-two centres of infection were involved. During 1933 this figure was reduced to fourteen outbreaks, involving nineteen centres of infection, while the number of susceptible animals immunized fell from 19,322 in 1932, to 5,976 head in 1933, though the necessity for two distinct inoculations with the vaccine-virus method entailed inoculations to the number of 10,282. From these figures it is apparent that rinderpest is still of frequent occurrence in the district, but an analysis of the situation of the centres of infection reveals that rinderpest has been largely confined to one area. Of the nineteen separate centres of infection mentioned above, no fewer than fourteen were situated within a radius of thirty miles from Kajiado, and outside this circumscribed area there occurred only three outbreaks involving five centres of infection. During 1932 fifteen of the thirty-two centres of infection were outside this radius, widely distributed throughout the district.

Bovine Pleuro-pneumonia.—Whereas during 1932 only two herds hitherto uninfected developed pleuro-pneumonia, during the year under review infection appeared in no fewer than fourteen such herds. Eight of these herds were moved under escort into permanent quarantines, but unfortunately grazing conditions did not permit of the inclusion of the others, on which a standstill order with a local quarantine was enforced. Wherever possible vaccination of all in-contact animals was undertaken at once, coupled with the segregation of clinically infected animals. The results attending this policy have been highly successful, and there is now no difficulty in persuading owners to submit their stock for vaccination, provided the danger of infection is imminent. In order to avoid congestion in the pleuro-pneumonia quarantines only stock known to have been infected with the disease are permanently confined, after being branded for purposes of identification. Vaccinated stock are allowed out of the quarantines as soon as this can safely be done.

A third permanent quarantine area was set aside at Soysien during the year, and the establishment of a fourth near Kisaju is contemplated.

During 1933 a total of 4,898 head underwent the full course of immunization, this accounting for 14,694 inoculations.

Blackquarter.—This disease was not as prevalent as in previous years, though it is still responsible for heavy mortality, especially in the Namanga district. One hundred and fifty head were vaccinated, but the fact that the vaccine is charged for makes the demand for vaccination almost negligible.

East Coast fever.—Owing to the drought, stock in the Shombole area were moved across the Uaso Nyiro into infected East Coast fever country, and heavy mortality resulted. A scheme is on foot to divert the Uaso Nyiro into its old course, thereby avoiding the infected country through which it now runs. East Coast fever is also prevalent south of Rombo and has been responsible for some mortality. There is no doubt that East Coast fever is steadily extending southwards from the Ngong Hills, as cases of the disease have occurred among Government transport oxen working on the road within twenty miles of Kajiado, with no history of their having been within ten miles of the Kiserian River, hitherto considered as the approximate boundary of the infected area.

Pleuro-pneumonia of Goats.—A severe outbreak of caprine pleuro-pneumonia at Shombole and Nguruman tended to reduce the number of these animals in the district.

Development. Dairying—Ghee Production.—Owing to the drought it was impossible to open any dairies during the normal season from April to June, but good rains during January allowed of the production of twenty-four tins of ghee at the Nailumbe Dairy during February and March. A small amount of ghee was produced under private auspices at Manga during the earlier part of the year.

In June an area of roughly 800 acres near Kajiado was set aside by the Local Native Council for use as a demonstration farm on which Ngong-trained Masai boys could run their own stock on approved lines and under conditions typical of the reserve as a whole. The farm is to be stocked during the short rains and the outcome of the experiment is awaited with interest.

General—Drought—No rain of any value whatever fell between January 31st and October 19th. The monthly mortality figure rose steadily from July onwards, until in October no fewer than 5,572 head were reported to have died from starvation, while for the year as a whole the total known mortality from drought amounted to roughly 17,000 head, or roughly 5 per cent of the total cattle population of the district.

The position was further aggravated by the loss of water concessions on the Tanganyika Border, while the drying up of Lake Kabongo in September forced about 8,000 cattle into areas already drought-stricken. In the Loitokitok area, however, great relief was afforded by the diversion of the Ol Sinnet River into a large natural basin, thereby making available about six miles of water frontage along the furrow, and bringing within reach grazing grounds hitherto inaccessible. Showers fell patchily throughout the district during November. Owing to this unequal distribution control of movement of stock was rendered extremely difficult.

Coast Province.

Staff.—One Indian Veterinary Inspector in charge of Veterinary Services for the Province; one Indian Veterinary Assistant on Port duty, one Indian Veterinary Assistant at Lamu and one at Mariakani. One African Training Centre is located at Mariakani but not yet developed.

Disease Control—Rinderpest.—This disease first appeared among a mob of cattle which arrived from the Tana River and in spite of all endeavours to eliminate it by the serum alone method, it spread into the districts of Kwale and Kilifi. Owing to drought, lack of water and grazing and the inability of natives to pay for serum or simultaneous inoculations, no steps could be taken to deal with the outbreaks other than strict quarantine and movement out of the districts under serum. The disease has almost run its course and in some localities it caused serious losses in conjunction with fly and East Coast fever. These districts are still in quarantine and movement of cattle destined for slaughter at Mombasa is carried out under serum alone through the Mariakani Centre.

Taveta District.—Rinderpest appeared on Lake Jipe border during the year and as reported before caused over 50 per cent losses amongst the infected herd. Attempts were made to persuade the natives to have their stock inoculated in the immediate vicinity but they declined on account of their inability to pay fees. The cattle from the vicinity of the outbreak were removed to a distance of about eight miles and strict quarantine and suspension of movement of stock assisted considerably in preventing the spread of the disease.

Lamu and Tana Districts.—The native stock owners in these districts have been very unfortunate on account of unusual rains at the beginning of the last year and a serious outbreak of fly appeared and caused very heavy losses among cattle. They hardly got over the trouble when rinderpest broke out and inflicted far heavier losses on their cattle than fly. The disease is still present but most of the remaining herds are immune. Due to the fact that disease appeared in all localities at once no preventive measures could be adopted beyond controlling movement of stock. Slaughter stock from Tana River after passing through a seven days' quarantine at Gulbanti and seruming at Mariakani has been permitted to keep up the meat supply of Mombasa and assist the natives to raise funds to pay their taxes.

Due to the rinderpest outbreak on the Lamu Island and Garissa, movement of stock had to be suspended for three months and this restriction is still in force as the last case of rinderpest was reported on the Island only a short time ago.

Development—Ghee.—Five dairies have operated during the year in the Kilifi District and four hundred gallons of ghee were produced and sold at Sh. 6/50 per gallon at Mombasa through this Department. The reputation of the dairy-produced ghee has now been established. There have been accidents, theft and adulterations due to neglect of the native supervising staff, which frequently interfered with the quality of the ghee, but careful inspection of all tins before passing to the consumer maintained the reputation established. Sale has been confined chiefly to certain consumers and any defects in the product were reported immediately and replaced at once. This state of affairs cannot possibly be allowed to continue and to make a commercial success it has been decided to introduce a fool-proof system as in other provinces for keeping up the quality of ghee and its reputation, by collecting all cream into a central dairy at Mariakani Training Centre and preparing ghee under supervision. The system will not only ensure pure ghee and eliminate accidents but it will assist in cutting down the expenses at each dairy.

Milk.—It has now been decided by the Mombasa health authorities that no milk will be permitted for sale unless produced under conditions approved by the Health Officer and it was agreed by the Administration that all milk passing through Mariakani and Mazeras to Mombasa should be inspected and sealed by the inspector working under the supervision of Mariakani Training Centre. All utensils will be sterilized at the dairies before being supplied to the natives and the milk dealers have agreed to pay a nominal levy per bottle to cover the expenses of the staff appointed by the Local Native Council. This scheme will be self-supporting and ensure a permanent market to the natives for their surplus milk in Mombasa market.

Hides.—Over 150 frasilas of hides were shade-dried at the Veterinary Station by the local butchers and sold at Sh. 15 per frasila locally.

General.—The following animals arrived from different places and were allowed to proceed to Mombasa and elsewhere after inspection :—

Cattle	Sheep and Goats	From	To
3,853	22,761	Kwale and Kilifi	Mombasa
1,297	292	Kitui	Mombasa
618	—	Tana River	Mombasa
5,768	23,053		

The list of stock products from Kwale and Kilifi districts passed through Mariakani and Mazeras to Mombasa market during the year is as follows :—

	Sh.
HIDES—1,500 frasilas at average Sh. 13 per frasila	195
SKINS—190 caoir at average Sh. 10 per caoir	1,900
GHEE—430 frasilas at average Sh. 20 per frasila	8,600
MILK—16,450 gallons at average 48 cents per gallon ..	7,896
CATTLE—5,768 head at average Sh. 20 per head	115,360
SHEEP AND GOATS—22,761 at average of Sh. 2/50 per head	56,902
TOTAL .. *Sh.*	190,853

In addition to the above large quantities of stock produce, particularly ghee and hides, have been taken to Mombasa market by road. The stock and produce passed through Mariakani and Mazeras have been drawn equally from Kilifi and Kwale districts.

Northern Frontier District.

Staff.—One Veterinary Officer and three Stock Inspectors. The African Training Centre continues its work at Isiolo.

Disease Control—Rinderpest.—This disease continued intermittently at Garissa during the year. Efforts continued to be made by the native veterinary staff under the control of the District Commissioner, with apparent success from time to time, but the disease always flared up again when it appeared to be practically finished. The amount of game, especially susceptibles such as buffalo and eland, complicate matters in attempting to clear up rinderpest.

Bovine Pleuro-pneumonia.—The survey and census of Samburu was completed during the first part of the year and the inoculations for pleuro-pneumonia were due to commence at the end of the year, but were delayed owing to staff organization. It appears that approximately 96 per cent of the herds are infected or contain recovered animals.

Foot and Mouth Disease.—This disease broke out at Isiolo during November, and rinderpest in December, among Somali cattle.

Trypanosomiasis.—Apparently this disease caused a heavy mortality among Samburu herds during the long drought as the cattle were forced to graze in fly belts usually left ungrazed.

An outbreak of Pustular Aptha affecting the mouth and tongue and nasal plane only, occurred in goats at Isiolo. Experimental work was commenced but it was found that the animals subjected to the tests were immune.

Development—Dairying.—The production of ghee suffered severely owing to the drought, only 917.6 lb. being produced in the first nine months and 1,183.4 lb. for the whole year.

Hides.—The proper treatment of hides is being demonstrated in Samburu, where bush drying bandas are being erected.

General—Grasses.—Further samples of grasses have been sent to Edinburgh and Kew for identification and analysis. The results are not yet to hand. The woolly finger grass planted experimentally has withstood the nine months drought very well and an experimental area of Indian Dhub grass also promises well.

Export.—The sheep trade from the provinces continues and the following are the figures for the year and for comparison those of 1932 :—

	Isiolo	*Lamu*
1932	68,160 ...	6,104
1933	40,262 ...	3,088

The cattle trade to Lamu was not possible during the greater part of the year, although 473 head were exported from Garissa in 1933 as compared with 343 in 1932.

CONCLUSION.

In concluding the Annual Report for 1933 I wish to thank all members of the staff of the Division for their assistance and hearty co-operation throughout a very difficult year.

H. H. BRASSEY-EDWARDS,
Deputy Director (Animal Industry)
and Chief Veterinary Officer.

(B) REPORT OF THE CHIEF VETERINARY RESEARCH OFFICER

STAFF.

The Chief Veterinary Research Officer was on duty throughout the year. As a further measure of economy, the post of Assistant Chief Veterinary Research Officer remained unfilled during the whole of 1933, although provision for this officer's services for two-and-a-half months was included in the estimates.

Mr. J. R. Hudson, Veterinary Research Officer, was on leave from 4th March to 2nd October, 1933, and Mr. W. Fotheringham, Veterinary Research Officer, proceeded on leave on the 23rd December, 1933. Dr. E. A. Lewis, Entomologist, was also on leave from May 13th to December 24th, 1933.

Mr. A. Walker, Laboratory Superintendent, was transferred to Headquarters Office, Nairobi, to take over the duties of Accountant, Agricultural Department, as from November 1st, 1933, and in his place Mr. A. J. Kemp was transferred from Headquarters. Mr. Kemp took over the duties of Acting Laboratory Superintendent on November 1st, 1933.

The posts of Yard Foreman and Assistant Storekeeper were retrenched at the beginning of the year, and Mr. A. MacDougall, holder of the former post, proceeded on leave on April 15th, 1933, pending retirement. Mr. G. W. Clochley, the Assistant Storekeeper, was absorbed into the office staff to fill a vacancy created by the transfer of Mr. A. E. Dawes to Headquarters office.

Owing to heavy leave movements of officers, the loss, which I trust will be temporary only, of the services of a senior research worker has been acutely felt, and the position has necessitated some curtailment of the research programme.

It gives me much pleasure to place on record my appreciation of the satisfactory manner in which the members of a depleted staff have carried out their duties during the year.

CORRESPONDENCE.

3,570 inward and 2,311 outward letters and telegrams were dealt with during the year, a total of 5,881.

In addition, 6,509 slides and specimens were examined and reported upon. A classification of these reports is given under the heading "Technical Routine".

LABORATORY FARM.

The area planted with Napier grass was increased during the year to 53 acres, and, in addition, a crop of maize and sunflower was grown.

About 600 tons of green fodder were reaped, and of this 500 tons were turned into ensilage.

Owing to drought conditions it was necessary to supplement the grazing during a great portion of the year.

In the latter part of the year an area of land bordering on the Mathari River was returned by the Department of Education to the Laboratory. This land was completely overgrown with bush and very thorough clearing was necessary.

The manurial and grazing plots in charge of the Soil Chemist and the Agricultural Officer in charge of Grassland Improvement were subjected ot the treatments laid down in the experiment. Valuable information has already been gained from the observations on these plots, and a report of the experimental work will be published later.

Eighty calves were born at the Lower Farm in the special breeding herd maintained for the rearing of cattle under tick-free conditions.

At the quarantine area, Naivasha, twenty-two acres of papyrus land were prepared for the growing of lucerne. Lucerne seed was obtained from South Africa, and although a good germination was obtained with seed inoculated at the laboratory, results were a little disappointing owing to the unequal distribution of rainfall. It is hoped to increase this area by another ten acres during 1934, and to replant those areas that have suffered from drought conditions.

LABORATORY WORKSHOPS.

Buildings.—No new buildings were erected at Kabete during the year by the Public Works Department. Numerous additions, alterations and repairs were undertaken by the laboratory workshop staff with the approval of the Public Works Department. A maintenance grant of £120 was received from the Public Works Department.

The following is a complete record of the work carried out by the workshop staff under the supervision of the laboratory mechanic :—

1. Erection of lucerne drying shed, 150′ × 30′ at the quarantine area, Naivasha.

2. Completing the erection of a 40′ × 30′ mud and wattle shed for pleuro-pneumonia experiments at the laboratory.

3. Rebuilding of the Dutch barn at the laboratory and fitting of sliding steel doors.

4. Rebuilding and renovation of post-mortem room, and installation of sliding steel doors.

5. Renovation of the library and museum.

6. Carrying out of all the necessary minor repairs to the laboratory, staff buildings and cattle sheds; repainting of several staff bungalows.

Steam Plant.—This plant was in daily use throughout the year; it was periodically inspected and reported to be in good condition. The necessary running repairs were attended to by the staff.

Gas Plant.—This plant worked satisfactorily throughout the year, and minor repairs were effected by the staff and laboratory mechanic.

Electric Plant.—The numerous electrical motors and appliances worked satisfactorily, and minor repairs and new installations were carried out by the staff; an electric drying oven for the manufacture of wireworm remedy was also constructed.

Water Supply.—The two water pumps belonging to our own supply worked satisfactorily. There is, however, a shortage of storage accommodation since the large tank at the laboratory had to be taken down. It will be recalled that an examination showed that this tank was beyond repair, and, up to the present, it has not been possible to purchase a new tank. With regard to the Municipal supply of water to the laboratory and staff bungalows, there is still a serious shortage owing to the small size of the supply pipe. The supply would be quite inadequate to deal with any outbreak of fire in the buildings.

The cold storage unit continues to give satisfactory service.

General.

In the laboratory workshop a considerable amount of special work has been carried out.

A serum filtering plant was constructed. Various appliances have been made for use in the laboratory. Small animal houses and cages have been built, and the usual repairs to motor transport, tractor, farm and transport implements have been effected.

FINANCE.

Expenditure.—The sanctioned expenditure for the year was £21,870 as against £25,014 for the year 1932, and reference is made under the heading "Revenue" to the difficulties that were experienced in maintaining production of vaccines and sera at its normal level with reduced votes.

Revenue.—Revenue collected from the sale of laboratory products totalled £2,314. Of this amount £288 was in respect of sales to other Governments.

This excludes revenue derived from rinderpest inoculations carried out by the field staff, which is returned under the head "Veterinary Inoculation Fees". The value of anti-rinderpest serum issued to the field staff at the scheduled rate of Sh. 2 per unit of 50 c.c. was £15,295.

The sale of surplus live stock and hides realized £103, and a further sum of £25 was derived from the sale of sundry stores.

TECHNICAL ROUTINE.

The following list shows the origin of the slides and specimens submitted to the laboratory for examination and report during 1933 :—

Bovines	3,616
Equines (Horses)	75
,, (Mules)	14
,, (Donkeys)	21
,, (Zebra)	1
Ovines	127
Porcines	47
Caprines	12
Canines	91
Avians (Fowls)	143
,, (Guinea-fowls)	1
,, (Turkeys)	5
,, (Ducks)	7
Various	66
Contagious Abortion Tests	2,736
Total	6,962

The classification of the diagnoses is as follows :—

BOVINES	Total examined 3,616
Anaplasmosis	117
Anthrax	60
Bacillary Necrosis	3
Blackquarter	25
Coccidiosis	11
Colon Bacillosis	7
Contagious pleuro-pneumonia	35
East Coast Fever	541
Hæmorrhagic Septicæmia	13
Heartwater	19
Helminthiasis	14
Paratyphoid	11
Redwater	110
Rinderpest	1
Small Piroplasms	214
Streptothricosis	5
Trypanosomiasis	128
Tuberculosis	2
Miscellaneous	265
Negative	2,035

EQUINES (Horses)	Total examined 75
Biliary Fever	3
Helminthiasis	10
Mycotic Pneumonia	1
Streptothricosis	1
Ulcerative Lymphangitis	4
Miscellaneous	9
Negative	47

EQUINES (Mules)	Total examined 14
Pneumonia	1
Trypanosomiasis	4
Ulcerative Lymphangitis	1
Negaitve	8

EQUINES (Donkeys)	Total examined 21
Biliary Fever	5
Miscellaneous	1
Negative	15

EQUINES (Zebra)	Total examined 1
Miscellaneous	1

OVINES	Total examined	127
Bacillary Necrosis	2	
Heartwater	4	
Helminthiasis	16	
Nairobi Sheep Disease	3	
Trypanosomiasis	1	
Streptothricosis	2	
Miscellaneous	29	
Negative	70	
PORCINES	Total examined	47
Anthrax	2	
Cysticercus cellulosæ	3	
Miscellaneous	12	
Negative	30	
CAPRINES	Total examined	12
Pleuro-pneumonia	1	
Negative	11	
CANINE	Total examined	91
Helminthiasis	9	
Tick Fever	12	
Trypanosomiasis	2	
Miscellaneous	11	
Negative	45	
AVIANS (FOWLS)	Total examined	143
Coccidiosis	2	
Fowl pox	5	
Fowl typhoid	28	
Helminthiasis	12	
Visceral gout	1	
Miscellaneous	30	
Negative	65	
AVIANS (Guinea-fowls)	Total examined	1
Fowl typhoid	1	
AVIANS (Turkeys)	Total examined	5
Miscellaneous	1	
Negative	4	
AVIANS (Ducks)	Total examined	7
Miscellaneous	1	
Negative	6	
RABBITS	Total examined	4
Coccidiosis	2	
Hæmorrhagic Septicæmia	1	
Negative	1	

Camels	Total examined		21
Trypanosomiasis		7	
Negative		14	
Eland	Total examined		1
Negative		1	
Gazelle	Total examined		2
Negative		2	
Impala	Total examined		3
Negative		3	
Kongoni	Total examined		4
Miscellaneous		1	
Negative		3	
Oribi	Total examined		1
Small Piroplasms		1	
Waterbuck	Total examined		1
Negative		1	
Wildebeest	Total examined		1
Negative		1	
Warthog	Total examined		2
Negative		2	
Flies	Total examined		4
Specimens		4	
Ticks	Total examined		19
Specimens		19	
Plants	Total examined		3
Specimens		3	

CONTAGIOUS ABORTION TESTS

TOTAL EXAMINED 2,736

Bovines	Total examined		2,726
Positive		266	
Doubtful		109	
Negative		2,351	
Caprines	Total examined		4
Negative		4	
Porcines	Total examined		6
Negative		6	

LIVE STOCK.

The following table shows the number of live stock, other than small animals and poultry, on the books of the laboratory during the year, including animals sent by or purchased from stock owners for experimental purposes, or for the preparation of laboratory poducts :—

SPECIES	On Hand 1–1–33	Increase	Decrease	On Hand 31–12–33
Horses	16	20	27	9
Mules	21	6	4	23
Cattle	717	782	614	885
Sheep	177	231	230	178
Goats	9	—	2	7
Pigs	7	10	10	7
Donkeys	—	44	37	7
Buffalo	1	—	—	1

LABORATORY PRODUCTS.

Anti-Rinderpest Serum.—The estimates for 1933, as originally framed, were based upon a production of 120,000 × 50 c.c. units of anti-rinderpest serum. At a later stage in the discussions, Item 129, Production of Vaccines and Sera, was further reduced by £700; Items 127 and 128 were also reduced by a total of £1,100 when compared with the estimates for 1932. Actually 137,525 × 50 c.c. units of anti-rinderpest serum were manufactured in 1933, serum production ceasing from 18th August.

It was only by cutting down the expenditure on maintenance and replacements of equipment to the very minimum, and by transferring £550 from Votes 127 and 128, "Apparatus, Machinery and Upkeep of Laboratory" to Vote 129, "Production of Vaccines and Sera" that the full quota of serum could be reached.

The stock of serum on hand at the beginning of the year was 14,920 × 50 c.c. units only, and immediate heavy demands for serum to deal with outbreaks of rinderpest in various parts of the Colony necessitated a prompt acceleration of the rate of production to approximately 20,000 doses a month, instead of the 10,000 doses per month upon which the estimates had been based.

Issues to the field staff during the year totalled 152,955 × 50 c.c. units, and the balance on hand at the end of the year was 8,995 × 50 c.c. units. The only sale to a foreign country was a shipment of 1,200 × 50 c.c. units to Shangai for the Culty Dairy Company.

Rinderpest Vaccine.—The quantity of rinderpest vaccine issued during the year amounted to 26,789 courses, or slightly less than in 1932.

It might be pointed out that the manufacture of rinderpest vaccine had, of necessity, to be spread over the whole of the year, and that the preparation of vaccine during the last four months of the year, when no serum was produced, was a much more costly procedure than the normal method of manufacture in conjunction with the routine serum production.

Anthrax Vaccine.—There was a slight decrease in the amount of anthrax vaccine manufactured; 14,554 doses were prepared and issued.

Blackquarter Vaccine.—The preparation of this vaccine reflects a slight fall in the demand.

Horse Sickness Vaccine.—The demand for this vaccine remained at the same level as in the previous year.

Paratyphoid Vaccines.—The demand for these vaccines is maintained, the figures showing an increase in the sales of "feed" vaccine.

Sodium Tellurite.—The demand for this product showed a very slight decrease as compared with 1932.

Of the other vaccines it is noteworthy that the issues of contagious pleuro-pneumonia vaccine have increased by 60 per cent as compared with 1932.

PREPARATION AND ISSUES OF LABORATORY PRODUCTS FOR THE YEAR ENDING 31ST DECEMBER, 1933

PRODUCTS	Balance on hand 31-12-1932	Prepared by Laboratory during the year	Returned to the Laboratory	Used at the Laboratory	Total Issues during year	Issues to other countries	Written off too old for Issue	Balance on hand 31-12-1933	
Anthrax Vaccine (single spore) ..	Nil	14,554	..	..	14,424	130	..	Nil	doses
Blackquarter Vaccine	,,	34,961	..	..	33,201	1,760	..	,,	,,
Bluetongue Vaccine	50,505	9,525	..	..	5,100	..	50,505	4,425	,,
Colon Bacillosis Vaccine	910	1,670	..	..	2,528	..	..	52	,,
Contagious Abortion Vaccine ..	Nil	664	..	..	664	..	..	Nil	,,
Fowl-pox Vaccine	,,	6,243	..	..	6,223	20	..	,,	,,
Fowl Typhoid (K.F.D.) Vaccine ..	,,	25,469	..	..	24,949	520	..	,,	,,
Horse-Sicknes Vaccine	,,	138	..	..	133	..	..	,,	,,
Pleuro-pneumonia Vaccine	,,	132,845	..	..	128,945	3,900	..	,,	courses
Paratyphoid Vaccine	,,	1,559	..	..	1,559	..	..	,,	doses
Paratyphoid Feed Vaccine	,,	3,810	..	..	3,810	..	..	,,	,,
Redwater and Anaplasmosis Vaccine	,,	118	..	..	118	..	..	,,	,,
Rinderpest Vaccine	,,	26,789	..	106	24,403	2,280	..	,,	courses
Serum, Anti-rinderpest	14,920	137,525	12,355	..	152,955	1,200	1,650	8,995	doses
Sheep-pox Vaccine	Nil	..	..	..	..	..	..	Nil	,,
Sodium Tellurite	,,	10,938	..	..	10,938	..	..	,,	,,
Trypanblue, (bovine	236	..	52	..	208	..	..	80	,,
Trypanblue, (canine)	40	106	..	..	86	..	..	60	,,
Tartar Emetic Solutiod	Nil	1,644	..	..	1,644	..	..	Nil	,,
Wireworm Remedy Powder ..	165,200	726,200	..	..	641,100	32,000	..	218,300	,,

Anti-rinderpest Serum	Field Staff ..	152,955 units of 50 c.c.
	Stockowners..	Nil
	Shanghai ..	1,200
	Total Issues, 1933	154,155 units of 50 c.c.

RESEARCH.

Rinderpest.—Experimental work has been mainly concerned with attempts to improve the quality of laboratory products employed in rinderpest prophylaxis.

Recently Jamieson and Powell (1931) reported on the use of a new compound, Sodium ethyl-mercurithiosalycylate, manufactured by the Eli Lilly Company, as an antiseptic and preservative for biological products such as vaccines and sera. These authors stated that this compound, for which the proprietary name "Merthiolate" has been adopted, would sterilize vaccines and sera when added to them in concentrations of from 1 : 5,000 to 1 : 10,000.

In view of the claims made for this preparation it was decided to test its disinfectant action on anti-rinderpest serum, in which the control of bacterial contamination by the use of ordinary antiseptics has always been a matter of considerable difficulty. The result was disappointing, largely because of the low pH of serum obtained by the coagulation method. The metallic portion of the salt is thrown out of solution in an acid medium, and its disinfectant acivity is lost. It did not prove possible to buffer the large quantities of serum sufficiently well to permit the use of this new compound as a preservative.

Powell, Jamieson & Jones (1933), recorded also that merthiolate in concentrations of 1 : 5,000 had no destructive effect on bacteriophage suspensions. This interesting finding led to an investigation at Kabete of its action on certain filtrable viruses.

A report of these tests will be published through the usual channels, but it may be recorded that the viruses of rinderpest and Rift Valley fever were found to be highly resistant to the antiseptic action of merthiolate.

Rinderpest virus extracted from spleen tissue was still viable after twenty-four days' exposure to merthiolate in a dilution of 1 : 5,000 at ±2° C. If any destruction of virus had occurred the amount destroyed was less than in an untreated control suspension of virus held under similar conditions. When small pieces of infected spleen tissue were incubated at 37°C. in a mixture of serum and Tyrode's solution containing merthiolate, the virus was completely destroyed within 72 hours, although control flasks were shown to contain viable virus at five days, and the virus was successfully sub-inoculated and similarly incubated for a further period of three days. It was thought probable that under these conditions the destruction of virus was caused by toxic products derived from disintegration of the tissue-cells that had been killed by the addition of merthiolate. This result does not, however, impair the usefulness of merthiolate as a preservative whenever it is necessary to hold rinderpest spleen virus for periods up to twenty-four days at cool-room temperatures.

Since merthiolate had apparently no direct action on the virus it was decided to test its value as a preservative for rinderpest vaccine prepared with dilute concentrations of formalin, and at the same time to attempt to confirm or refute the findings of 1927 with reference to the superiority of vaccines made with weaker concentrations of formalin over those made with higher concentrations up to 1 : 100.

In the original experiments of 1927 it was found that when vaccines were prepared at cool-room temperatures, their potency appeared to vary inversely with the concentration of formalin, within the limits tested. The addition of formalin to a concentration of 1 : 1,500 did not invariably inactivate all the virus; and vaccines prepared in this manner, although highly efficacious, were not safe for general issue. Since a concentration of 1/1,000 formalin appeared to produce a much more potent vaccine than a concentration of 1/500 formalin, the former concentration was chosen for routine use in vaccine preparation. It was realized that at this concentration the disinfecting power of the formalin was feeble, and that accordingly it was necessary to rely mainly on careful methods of preparation to reduce bacterial contamination to a minimum. When large scale production had been under way for some time it was found that occasional batches of vaccine were so heavily contaminated with bacteria as to produce abscesses in inoculated cattle.

A preliminary bacteriological examination showed that the lowest concentration of formalin that could be relied upon to effect fairly rapid sterilization of vaccine suspensions was 1 : 100. A series of tests of the relative potency of vaccines prepared from the same batch of material with different concentrations of formalin was then attempted by Mr. Hudson, and the results—though indeterminate—appeared to indicate that if there were any differences in potency between the test samples they were slight, and probably not as great as individual differences in susceptibility among the cattle employed in the test.

The 1933 series of experiments which are tabulated below show that the addition of merthiolate to a formalized vaccine does not in any way impair the antigenic qualities of the final product. The experiments indicate also that when a homogeneous batch of cattle is used in the test, as in this instance, and when the dose of vaccine, or rather the potency, is not too high, it becomes possible to demonstrate a slight but probably significant difference in favour of the vaccine prepared with the lower concentration of formalin. It might be remarked that the exceptionally good results obtained with the samples tested after four months' storage are in all probability to be referred to the fact that these animals received the last of each batch of vaccine, i.e. the bottom of the bottle, which may have included sedimented tissue with a higher virus content.

TEST RESULTS

Type of Vaccine	Dose	Age of Vaccine When Tested			
		I week	1 month	2 months	4 months
1/1,000 Formalin	15 cc.	Immune	Immune	Immune	Immune
	5 cc.	Immune	Immune	Temp. reaction	Immune
1/1,000 Formalin–Merthiolate 1/10,000	15 cc.	Immune	Immune	Immune	Immune
	5 cc.	Immune	Mild clinical reaction	Immune	Immune
1/100 Formalin . .	15 cc.	Temp. reaction	Mild clinical reaction	Temp. reaction	Immune
	5 cc.	Temp. reaction	Clinical reaction 7 days	Temp. reaction	Immune
1/100 Formalin–Merthiolate 1/10,000	15 cc.	Temp. reaction	Clinical reaction 7 days	Immune	Immune
	5 cc.	Immune	Temp. reaction	Acute clinical temp. reaction. Death 7th day	Immune

It has recently been demonstrated by Perdrau and Todd (1933) that sensitiveness to the photodynamic action of methylene blue, previously observed in ceratin strains of bacteriophage and in the virus of vaccinia, is also characteristic of many other filtrable viruses. Of the viruses tested, those of vaccinia, herpes, fowl plague, louping-ill, Borna disease, Fujinama's tumour and canine distemper all proved highly sensitive to the photodynamic action of methylene blue when exposed in suspensions free from living cells. Further it was shown by the same authors that if spleen suspensions from animals killed at the height of a reaction to the virus of distemper are treated with methylene blue and irradiated, they furnish a vaccine superior to that produced in the ordinary way by the action of formalin. On the other hand, Perdrau and Todd found that the viruses of foot and mouth disease and infectious ectromelia exhibited a much greater resistance to the photodynamic action of methylene blue.

The virus of rinderpest has recently been submitted to the photodynamic action of methylene blue under conditions similar to those employed by Perdrau and Todd, i.e., free in solution, devoid of cells, and in a shallow layer at a distance of 20 cm. from a 100-c.p. Pointolite lamp. The solution employed was not a filtrate but a supernatant obtained by centrifuging a ''crushed'' suspension of spleen tissue at 4,000 revolutions for twenty minutes. The period of exposure to the light was twenty minutes and the dilution of methylene blue 1 : 50,000. Under these conditions there was no apparent destruction of rinderpest virus.

These results did not encourage any further attempts to produce vaccine by the photodynamic action of methylene blue. There is, however, one other point of practical importance to the worker on rinderpest. Not infrequently when performing inoculations by the serum simultaneous method the operator may add trypanblau to the blood used as a source of virus, to guard against accidental transmission of blood protozoa. Since inoculations are usually carried out in bright sunlight there might be serious failures should trypanblau exert a photodynamic destructive action on rinderpest virus similar to that manifested by methylene blue on the other viruses. However, a parallel series of tests, employing trypanblau in a dilution of 1/50,000, failed to demonstrate any virucidal action on the virulent blood. Higher concentrations up to 1 per cent and even 2 per cent have been employed without harming the virus. It is probable that the location of the virus within the living leucocytes affords adequate protection against any possible photodynamic effect.

It has been possible during the year to carry out further long-term immunity tests of cattle vaccinated in December, 1927. The cattle tested, fourteen in number, were the remainder of 167 animals treated with completely inactivated vaccine followed by a partially inactivated vaccine. It will be recalled that in 1927, experimenatl vaccinations were carried out on the Kipipiri farm of Sir John Ramsden, treating batches of animals in three different ways. Since the time of the vaccination the farm in question has been entirely free from rinderpest, with the exception of one small outbreak that infected a number of unvaccinated calves in 1928. The first immunity tests of a random sample of vaccinated animals drawn in 1929 demonstrated quite conclusively that this small outbreak of rinderpest had not in any way affected the experimental animals, confirming the statement of the farm manager that the vaccinated cattle had never been exposed to the least risk of contact with the infected calves. Since that time rinderpest has not appeared on the farm.

The animals were divided into three lots. The first batch of 127 was treated with a partially inactivated vaccine (formalin 1/1,500), which provoked reactions in 108 out of 127 animals. The second lot of 79 animals, including seventeen pregnant cows, was treated with a completely inactivated vaccine (formalin 1/1,000). There were no reactions to this vaccine. The third batch of 169 animals received first a dose of the completely inactivated vaccine, given to Lot 2, and seven days later a dose of the partially inactivated vaccine used on Lot 1. To this second vaccination there were four transient temperature reactions.

The testing of random samples drawn from the three batches of vaccinated animals was commenced at 12½/15 months; further samples from Lots 1 and 3 were tested at 32 months, and a final test of thirteen animals from Lot 3 was made 63 months after vaccination. The results are tabulated below :—

Number Tested by Inoculation with Virus	Period Between Vaccination and Test	RESULTS											
		Lot I				Lot II				Lot III			
		No reaction	Temperature reaction	Clinical rinderpest	Deaths	No reaction	Temperature reaction	Clinical rinderpest	Deaths	No reaction	Temperature reaction	Clinical rinderpest	Deaths
90	12½–15 months	27	2	—	—	13	8	3	—	36	1	—	—
25	32 months	4	5	—	—	—	—	—	—	12	4	—	—
13	63 months	—	—	—	—	—	—	—	—	11	1	1	—

Of the reactions given by the animals tested from Lot III, the single reaction to the first test consisted of one morning temperature of 104° on the sixteenth day after the inoculation of virus; the four reactions during the second test were relatively transient, the longest being only of four days' duration. Of the two reactions to the third test in this lot the temperature reaction lasted three days only, and the mild clinical attack of rinderpest in the other reacting animal lasted for a similar period. In recording these results a single morning temperature of 103° or higher at any time from the second to the fifteenth day after inoculation is accounted a reaction. Prior to the inoculation of virus many of the animals included in these tests were submitted to the heaviest contact infection that it was possible to arrange at Kabete for periods of up to five weeks, and in no case was any reaction observed during this period of exposure. The thirteen animals in the last test were all pregnant cows, and eight of them calved normally during the contact period.

One cow not included in the table aborted roughly one month before term. She was a positive reactor to the agglutination test for contagious abortion and unfortunately died of septicaemia following metritis before the inoculation of virus could be carried out. Post-mortem she displayed no signs of rinderpest.

It may be concluded from these observations that treatment with a dose of completely inactivated vaccine followed by a vaccinating dose of an active spleen virus, or even of a partially inactivated virus, will provoke an immunity serviceable for a period in excess of five years. Probably the immunity will persist throughout life, in spite of the fact that in the process of immunization very few demonstrable reactions are produced by the virus. Further experiments along the same lines have indicated that if the virus is fully active and has been liberated from the spleen cells, it is not necessary to employ a vaccinating dose. Reference was made in the 1932 annual report to a large scale experiment, in which approximately 1,100 animals were treated by this method. Samples of this herd will be submitted to testing towards the close of 1934 or the beginning of 1935.

Data on the duration of the immunity provoked by treatment with completely inactivated vaccine alone are relatively scanty in literature. It has already been recorded in these annual reports that calves outgrow the immunity conferred by two or three doses of inactivated vaccine in the course of a few months, the younger the subject at the time of vaccination the more rapidly immunity is lost. With adult cattle it is possible to put a more definite term to the period for which immunity will last. Hall in Nigeria records that complete protection against contact infection persisted for eight months after a single inoculation of inactivated vaccine representing 8.3 grammes of spleen pulp.

In the experiments to which Table I refers, the animals of Lot II (inactivated vaccine alone) received the equivalent of 5 grammes of spleen pulp. Immunity to contact infection in five animals tested at thirteen months was still complete, although the immunity was incomplete against inoculation with virus. Fortunately, it has been possible also to test the immunity of small samples of very high-grade Ayreshire cattle from a herd that has been twice vaccinated with completely inactivated vaccine at an interval of two-and-a-half years. No active rinderpest virus has been used on this farm during the past twelve years. The first vaccination consisted of two inoculations each containing approximately 3.7 grammes of spleen pulp given at seven days' interval, and the second of three inoculations each equivalent to 2.5 grammes of spleen tissue.

A cow was exposed to the heaviest contact infection that could be arranged at Kabete, nine months after the first vaccination. Sixty-two days after exposure the animal exhibited a transient temperature reaction lasting four days. Sub-inoculation of blood taken at the height of this reaction provoked a similar temperature reaction, and apparently immunised a susceptible animal against rinderpest.

Two more cows were submitted to a similar contact infection fifteen months after the first vaccination. One of them showed a very brief temperature reaction on the seventh and eighth days, the nature of which was not confirmed by sub-inoculation. There was no other reaction in these two animals during twenty-three week's exposure. Neither could they be induced to react by repeated inoculations of virus.

Two years after the first vaccination six animals were subjected to a test, four by inoculation and two by contact. Three of the four inoculated animals reacted, one fatally; both the contact animals in this experiment reacted, one of them dying of the disease.

It is evident that by two years the degree of protection remaining is, in most cases, negligible.

A further batch of six animals was drawn from this herd for testing, two years after the second vaccination. All were inoculated with virus; four of the animals gave no reaction and two showed a temperature reaction lasting from the fourth to the seventh day.

It is interesting to note that the two reactors were both under three months of age when the first vaccination was carried out. The remaining four animals were all more than eighteen months old at the time of the first vaccination. Further tests are now in progress, but it is quite evident that the second vaccination has protected for a longer period than the first vaccination, and that when vaccination is repeated there may be a cumulative effect, even when the interval separating the two treatments is as great as 2½ years.

Nairobi Sheep Disease.—As recorded in the 1931 and 1932 reports investigations have been in progress to determine the species of tick responsible for outbreaks of this disease in certain districts where the normal vector, *Rhipicephalus appendiculatus*, is absent or rarely occurs . Tests have now been carried out with all the tick species found on sheep in these areas.

It was reported in 1931 that *R. simus* would not feed as larvae or nymphs on sheep. The usual hosts of these two instars are small rodents, particularly *Arvicanthis abyssinicus*. We have been able to show that *Arvicanthis* can be infected with Nairobi sheep disease by the inoculation of virus, and that nymphs of *R. simus* become infected when fed on such inoculated rats. The nymphs, however, lose the infection upon moulting to adults.

Similarly we have been able to demonstrate that engorged nymphs of *R. evertsi* fed on an inoculated sheep become infected; but after moulting to adults they are not able to transmit the disease to susceptible sheep.

Nymphs of *R. pulchellus* failed to transmit the disease when inoculated to a susceptible sheep twenty-five days after an infected meal, although nymphs of *R. appendiculatus* fed on the opposite ear at the same time, after moulting to adults, transmitted the disease. Transmission by naturally infected *R. bursa* has already been reported.

In our experiments it has not been possible to induce the immature stages of *Hyalomma aegyptium* to feed on the ears of sheep, and it seems unlikely that this species can be a natural vector.

Unexpectedly successful transmission has, however, been effected with the last species to be tested, *Amblyomma variegatum*. Larvae of this species, when infected on sheep, will transmit as nymphae; and infected nymphae will transmit when moulted to adults. Transmission through the eggs, which it will be recalled occurs in *R. appendiculatus*, has not yet been demonstrated. With this species a greater proportion of failures has been experienced than is usual with *R. appendiculatus*, and epizootiological experience lends support to the view that *Amblyomma variegatum* is a less efficient vector than *Rhipicephalus appendiculatus*. A detailed account of the experiments is now in press.

Bluetongue Virus in Cattle.—Reference was made in the Report of the Conference on Co-ordination of Veterinary Research held at Kabete in January, 1934 (page 23), to the recovery during 1933 of strains of bluetongue virus from cattle.

In February, 1933, two rinderpest virus-makers, when brought up for bleeding on the fifth day after inoculation with our stock rinderpest virus, were observed to be showing abnormal symptoms. The eyes were staring, with dilated pupils, and there was a degree of incoordination amounting almost to paralysis of the hind limbs. In view of the unusual nature of the symptoms it was decided not to utilize the blood of these animals for hyperimmunisation; but in an attempt to investigate the etiology of the condition, three cattle, immune to rinderpest, and three sheep were inoculated with the blood. Of the inoculated cattle, two showed no reaction at all, while the third showed a transient temperature reaction on the tenth day after inoculation. Blood taken at this period failed to produce any reaction when subinoculated into sheep, and the sheep were later shown to be susceptible to bluetongue. All three sheep inoculated with the original bovine blood developed severe bluetongue after the normal incubation period, and in each case the infection terminated fatally.

Sub-inoculation from two of these sheep during the reaction again produced bluetongue, ending fatally in all four of the sheep inoculated.

In five cattle similarly inoculated no reactions were observed. One of these cattle, which was susceptible to rinderpest, was shortly afterwards infected with rinderpest and towards the close of the rinderpest reaction was bled for inoculation into four additional sheep with the idea of demonstrating whether a rinderpest reaction could provoke an appearance of bluetongue virus in the blood in an animal that was not normally susceptible. The result of this attempt was again negative.

A series of inoculations was undertaken to find out whether other cattle of the same batch were carrying the virus of bluetongue in their blood. Altogether the blood of twenty-two cattle was tested in this way and in one case only did the inoculation of blood from an apparently normal animal produce bluetongue in sheep.

It is remarkable that the bluetongue virus originally recovered from cattle appeared to be of higher virulence for sheep than strains that are normally recovered from sheep in naturally occurring outbreaks of bluetongue. In seven sheep inoculated during the first two passages of this virus, the infection was invariably a highly acute one, leading to a rapidly fatal result.

Horse Sickness.—Mr. Fotheringham continued his histopathological studies of this disease during the year. Following the reports of Nieschulz and Alexander, he attempted to establish a strain of horse sickness virus in the brains of mice. The attempt succeeded with "O" virus and at the end of the year this strain was in its twenty-sixth passage. By this time the survival period of inoculated mice had been reduced to seven or eight days. Tests carried out on horses indicate that up to the tenth passage there is no recognizable attenuation of the virus for the horse; but by the twenty-second passage some degree of attenuation is obtained, the incubation period is prolonged and the reaction may be mild, or even symptomless. It is hoped that with repeated passage in mice a neuro-virus will be produced which can be used safely for the inoculation of horses, either alone or following a single dose of formalized vaccine.

Snotsiekte.—During the year an attempt has been made to investigate a disease which in many of its features closely resembles true snotsiekte, as discovered by Mettam in South Africa. This disease, which has often been referred to as malignant catarrh, is usually seen in young animals, i.e. weaners or yearlings. Although wildebeeste have been shown to act as natural reservoirs for the virus of true snotsiekte, the disease under investigation has always been encountered on farms whose situation precludes the possibility of any contact between cattle and wildebeeste. Clinically, the disease is not so acute as snotsiekte, but occasionally it can be responsible for heavy mortality. Outbreaks require careful differential diagnosis to exclude rinderpest and sweating sickness. In preliminary experiments the disease appeared to be transmissible by blood inoculation, but the incubation period after inoculation was extremely variable and might be as long as thirteen weeks. The average incubation period in the cases produced in the laboratory was between nine and ten weeks. The experimentally reproduced disease was mild in character and recovery was the general rule. The causal agent appeared to die out in attempts at sub-inoculation from experimental cases. A strain of snotsiekte virus was obtained from the Masai Reserve for comparison with the disease under investigation, but here again, although th disease was successfully transmitted with the original material, the virus failed to survive sub-inoculation.

The investigations will be continued when further material is available .

Rabies.—During the year a more rapid acetone embedding method has been adopted in diagnosis. Thin pieces of hippocampus fixed in formalin are placed in acetone for 2½-3 hours, after which they are transferred, first to soft and then to hard paraffin, remaining one hour in each. The tissues are immediately embedded and cut.

By this method a diagnosis can be given on the same day, if the specimens are received in the early morning.

During 1933 there were twenty-two positive specimens out of a total of sixty-three brains received for examination. In one instance a brain in which no Negri bodies could be demonstrated proved positive when inoculated into rabbits.

Two fresh strains have been recovered, one from a dog and one from a jackal. The incubation periods of the first passage were the nineteen and seventeen days respectively. The jackal strain to which reference is made on page 285 of the Annual Report of 1932 was in its twenty-fifth passage at the end of the year. The incubation periods of the last four passages have been the fourteen, fourteen, seven and eleven days.

The experiments with etherized vaccine prepared from the brains of lambs had to be discontinued during Mr. Hudson's absence.

So far, rabies has not been diagnosed in any small carnivore other than jackals.

TABLE SHOWING DIAGNOSIS ON SUSPECTED RABIES BRAINS, 1933

	Animal	Kisii	Kericho, Sotik	Koru, Songhor, Muhoroni, Mteitei	Fort Ternan, Lumbwa, Kedowa	Mau Summit, Londiani, Njoro, Molo, Equator, Nakuru	Eldoret, Plateau, Burnt, Forest	Nandi	Kisumu, Maseno Kakamega Sangalo	Trans Nzoia	Marsabit	Nairobi, Machakos Ngong, Nyeri Escarment, Ulu	Total
Positive ..	Dog ..	1	2	1	..	..	1	..	2	..	..	..	7
	Jackal	..	4	3	2	..	2	3	..	..	..	..	14
	Ox ..	..	..	..	..	..	1	..	..	..	..	..	1
Total positive all animals ..	..	..	..	..	..	..	..	..	..	..	..	..	22
Negative ..	Dog ..	..	3	3	3	2	2	..	4	2	1	8	28
	Jackal	..	..	..	..	1	1	2	1	1	..	1	7
	Ox ..	..	..	..	..	..	1*	..	..	..	..	..	1
	Cat ..	..	1	..	..	..	..	..	..	..	..	..	1
	Rat ..	1	..	..	..	..	..	..	..	..	..	..	1
	Skunk	..	..	1	..	..	..	..	..	..	..	..	1
Total negative all animals ..	..	..	..	..	..	..	..	..	..	..	..	..	39
Too decomposed for diagnosis	Dog ..	..	..	1	..	..	..	1	..	1	..	..	3
	Jackal	..	..	..	..	..	..	1	..	..	..	..	1
TOTAL BRAINS EXAMINED ..		..	..	..	..	..	..	..	..	..	..	..	65

*Probably a positive. No Negri bodies found, but brain was from same herd as the positive case and showed lesions.

BACTERIAL DISEASES.

Contagious Bovine Pleuro-pneumonia.—Etiological investigations have been continued with some degree of success. It will be recalled that in the Annual Report for 1932 it was stated that the acute clinical and pathological picture of bovine pleuro-pneumonia had been reproduced in one animal by the intratracheal injection of a small quantity of filtered virulent thoracic lymph from an acute natural case. This has been the only positive result out of twenty attempts, employing this particular method of inoculation. A typical culture was obtained from the thoracic lymph of this animal and Berkfeld filtrates of this culture upon injection into susceptible cattle produced severe local reactions, terminating fatally in four animals out of six inoculated.

In further attempts to reproduce the disease experimentally the "embolus-production" technique has been employed. Thoracic lymph from a natural case has been incorporated in agar and injected into the jugular vein, with precautions to prevent infection of the tissues at the site of inoculation. Similar embolus injections have been given, employing first generation culture from thoracic lymph, and first generation culture from lymph taken from a shoulder "tumour".

With thoracic lymph injected in this manner, two positive results have been obtained. In the one case a temperature reaction was observed from the thirteenth to the eighteenth days, and in the other during the fourth week after inoculation. No clinical symptoms were observed. The first animal was destroyed forty-eight days after inoculation and was found to have a sequestrum in one lung. The second animal, destroyed eight weeks after inoculation, had a single sequestrum. Histologically these lesions were characteristic of pleuro-pneumonia, but no organisms could be demonstrated by the usual cultural methods.

With first generation culture obtained from thoracic lymph one transmission has been obtained. No temperature reaction occurred, although there was a local swelling at the site of inoculation during the third week. This animal was destroyed seventy days after inoculation, and was found to have a typical pleuro-pneumonia sequestrum in one lung. Cultures could not be obtained. Attempts to produce infection with first generation cultures derived from shoulder lymph have so far failed, but further experiments are in progress. The unexpected successes obtained with this method of inoculation indicate that it is now possible to study the survival of the virus in sequestra under satisfactory experimental conditions.

There can be no doubt as to the great value of any fresh information concerning the spread of the disease under natural conditions. In particular is it essential to the successful framing of veterinary police regulations to know something of the length of the usual incubation period of the naturally contracted disease. But the case recorded in the last annual report where a self-limited infection leading to sequestrum formation was obtained by contact, and the single classical case of Chauveau in which infection was transferred by joining the heads of a healthy and an infected animal by means of a canvas bag, are the only instances of contact infection under controlled experimental conditions reported in veterinary literature.

During the year the disease has been transmitted twice by simple contact with acute naturally contracted cases of the disease. In the first case the exposed animal was in contact with acutely infected cattle for a period of ten days only. After removal from contact this animal remained normal for a period of thirty-one days, when a temperature reaction developed, lasting eight days. Post-mortem examination four months from the commencement of the experiment revealed a sequestrum in the left lung well isolated and roughly the size of a cricket ball. There was also an extensive pleuritic adhesion.

A second animal exposed at the same time reacted twenty-five days after the close of a period of ten days' contact. The reaction lasted roughly fifteen days. He was destroyed 160 days after the commencement of the experiment, and was found to have a pleuritic adhesion and one small sequestrum.

It is evident then that the disease can be transmitted by contact with acute naturally contracted cases, and that the incubation period after contact infection may be as long as thirty-one days, an important point to the administrator of sanitary regulations for the control of pleuro-pneumonia.

The demonstration of the possibility of obtaining infection by contact under experimental conditions has an important bearing on another issue. The discovery of the organism of pleuro-pneumonia by Nocard and Roux occurred so long ago that one is apt to forget that so far it has not been possible to fulfil Koch's postulates in respect of the organism. Now that experimental reproduction of the clinical condition and infection by contact have both been accomplished, it should be possible to fulfil the postulates by a reproduction of the disease with culture and a demonstration of the contagious character of the condition so reproduced.

The investigation of biological diagnostic tests has been continued, and comparative tests have been made of the efficacy of the Dahmen precipitin-agglutinim test; the agglutination test, and a flocculation test in which a saponin-lysed antigen has been employed. Generally, the results have been discouraging, the tests failing badly when subjected to critical examination.

Contagious Bovine Abortion (Brucellosis).—Out of 2,675 blood samples tested by Mr. Danks at the laboratory during this year, 363, or 13.6 per cent were either positive or doubtful. These samples were received from roughly fifty-four sources, including farms in the settled area, Government stock farms, and native training centres in the reserves. Although this percentage of reactors cannot perhaps be accepted as a true indication of the incidence of the disease in the Colony it is nevertheless of interest to compare it with the results of twelve complete herd tests, in which the rate of infection varied from about 1 per cent to 33 per cent. In most of these herds the proportion of reactors fell between 7 per cent and 9 per cent. With this relatively low rate of herd infection there is every hope that segregation measures, properly applied and coupled with repeated whole herd testing, would, if undertaken in the near future, prove entirely successful in eradicating the disease, at least from the herds owned by Europeans. Already there are quite a number of farms that have been freed from contagious abortion, and it is hoped that with increased co-operation between stock farmers, district veterinary officers and the laboratory, this number will continue steadily to increase.

Viable bacilli of contagious abortion have been recorded by Klimmer in butter and fresh cheese, but those varieties of cheese that take three months or more to mature are not considered to be a source of danger. Tests carried out at this laboratory on samples of butter from cows positive to the agglutination test gave negative results, and no evidence of infection could be found in guinea pigs that had been fed or inoculated with the butter. Further experiments along these lines are necessary.

Positive agglutination tests have been obtained with whey in the place of serum, and bacilli have also been recovered from the milk of infected cattle. Attempts have been made to recover porcine strains of *Brucella abortus*, but so far all samples received from suspected outbreaks of the disease in pigs have proved to be negative.

Experimental treatments on known carriers of *Brucella abortus* with "formo-abortin", a formalised extract of the causal organisms, have met with no success. Other therapeutic agents are being tested. Strains of *Br. abortus* are being collected from as many human and animal sources as possible in various parts of East Africa. These strains are typed against known strains received from other parts of the world.

A large number of type strains of *Br. abortus* and *Br. melitensis* for comparative study have been received through the coutesy of Dr. G. S. Wilson, of the London

School of Hygiene and Tropical Medicine, and Dr. W. H. Andrews, The Ministry of Agriculture and Fisheries Veterinary Laboratory, Weybridge, England.

Haemorrhagic Septicaemia.—Cases of haemorrhagic septicaemia have occurred, especially in calves, in which *post mortem* examination has revealed only an intense congestion of the pharynx and larynx, enlarged and prominent tonsils and a scanty gelatinous exudate surrounding the cartilages of the larynx. Occasionally there has been also an acute inflammation of the small intestine, with destension of the mesenteric blood vessels.

Frequently quite a large number of deaths have occurred in an infected herd the cases being of this type, without any manifestation of a local subcutaneous swelling. It has always been possible, however, to recover pure cultures of the organism from the tonsils, blood and viscera, and diagnosis has not presented any unusual difficulty.

An outbreak of rabbit septicaemia was observed by Mr. Danks in the Limuru area. Cultures of the isolated organisms, although highly pathogenic for rabbits, did not provoke any reaction in cattle when inoculated subcutaneously or into the prescapular lymph gland.

Paratyphoid Infection in Calves.—During the year a number of type strains of *Salmonella* was obtained from the Lister Institute, and organisms isolated from outbreaks of paratyphoid in calves in this Colony were examined by the agglutinin-absorptio nmethod. The results of these tests prove quite conclusively that the irganism in question is a *Salmonella* Dublin type, in spite of minor differences in its sugar fermentation reactions. The question of infection of calves from carrier adult animals received further attention and a report will shortly be published.

On the question of the pathogenicity of this organism, it is significant that outbreaks of paratyphoid in Northern Europe, including Great Britain, are known to be commonly due to infection with *Salmonella* Dublin, since in these countries tick-borne disease can hardly be a factor in the production of losses from this infection, this is evidence corroborative of the pathogenic character of the Kenya paratyphoid organism, and it confirms similar conclusions that had been reached by another method, namely, an investigation of the relative ages at which death from paratyphoid and illness from anaplasmosis occurs.

Anthrax.—As a result of certain alterations in the composition of the medium used for growing vaccine strains of the organism, excellent sporulation of the bacilli has been obtained. Vaccines prepared in this manner by Mr. Danks have been shown to possess high antigenic properties, as small a dose as .005 c.c. protecting against 2,000 minimal lethal doses of virulent culture. The vaccines on inoculation provoked some temperature reactions and mild local swellings which disappeared within a few days.

Blackquarter.—During the year we have continued to prepare the natural aggressin type of vaccine, the results have been completely satisfactory and we no longer hear of losses from blackquarter within a month of the animal's having been treated with vaccine.

An outbreak of blackquarter, in which a severe mortality followed the feeding of cattle on a locally prepared bone-meal, was investigated by Mr. Fotheringham. In several samples of this bone-meal that had been fed to the affected cattle, it was possible to demonstrate the presence of both *C. chauvoei* and vibrion septique, and to kill pigs, rabbits, and sheep by the inoculation of material. A feeding experiment at the laboratory with a few calves and sheep gave only negative results.

Respiratory Diseases of Sheep.—Mr. Fotheringham has continued his work on this group of diseases.

During the year an investigation was made of the cause of heavy mortality in a large herd of kongoni in the Gilgil district. The losses were found to be due to heavy infestations with a new species of *Protostrongylus*, of which a description will shortly be published. The lungs of the affected animals provided much valuable comparative material for Mr. Fotheringham in his study of the changes that are initiated in the lungs of sheep as a result of infestation with members of this genus.

PROTOZOAN DISEASES.

East Coast fever.—Several experimental treatments of East Coast fever with thymus gland extracts have been carried out by Mr. Danks, in accordance with the suggestion made in a recent paper (Cowdry and Danks, 1932). Treatment was not commenced until Koch's bodies were demonstrable in gland smears. Various types of thymus gland extracts were inoculated intravenously, but no change in the normal development of the parasite occurred, and all the animals eventually succumbed to East Coast fever.

Thymus extracts appeared to cause a rapid fall in the temperature of some of the treated animals, and repeated inoculations may possibly have prolonged the course of the disease. Liver extract, or stovarsol combined with thymus, gave no better results.

It is interesting to record here that on a farm near the laboratory many deaths amongst milking cows had occurred from a condition of unknown etiology, all attempts to transmit the disease by inoculation having failed. From *post mortem* examination it appeared to resemble to some extent "Nairobi quarantine disease", but it did not respond to treatment with adrenalin. The principal symptoms were a sudden rise in temperature and drop in milk yield, and on *post mortem* there were numerous subcutaneous haemorrhages. Intravenous inoculation of thymus extract, prepared for the treatment of East Coast fever, resulted in rapid return of the temperature to normal, and in most cases the milk yield also returned to normal within a few days.

Experiments on the treatment of East Coast fever with other therapeutic agents will continue as time and opportunities permit.

Entomological Investigations.—During the three years (1930-1933), the distribution of tick species has been investigated by Dr. Lewis in a section of the Rift Valley, the Trans Nzoia and the Uasin Gishu districts, and in the Masai Reserve. The area surveyed is, approximately, 22,058 square miles, of which 6,881 square miles are divided into farms and alienated; and 15,177 square miles are in naitve reserve. These figures represent about one-tenth of the total land area of the Colony and Protectorate of Kenya.

In addition many smaller areas and farms have been visited and investigated from time to time.

Although only a comparatively small area of the Colony has been surveyed, the following observations with regard to the distribution of *Rhipicephalus appendiculatus*, the chief vector of East Coast fever of cattle, may be of interest.

The Colony has for long been considered divided into infected East Coast fever, or "dirty" areas, and non-infected, or "clean" areas, and it has been stated that the extent of these areas is determined by the natural ability of the vecting tick to multiply under particular environmental conditions

The original boundaries have from time to time been revised, and changes are still being made.

As a result of his investigations during the past three years, Dr. Lewis considers that it is possible to divide the Colony into areas of the following types :—

(*a*) Areas in which *R. appendiculatus* and East Coast fever have been established for many years. These are endemic East Coast fever areas. Apparently some districts have become heavily infected with *R. appendiculatus* since the determination of the original boundaries.

(*b*) Areas where neither the tick nor the disease at present exist.

These comprise many of the exposed, treeless plains; some districts at over 9,000 feet.

(*c*) Uncontrolled areas into which the ticks are spreading and gradually obtaining a foothold.

These are potentially "dirty" areas. Recent investigations have revealed the presence of *R. appendiculatus* in large numbers where it was not known to exist previously, or where its existence was merely suspected.

(*d*) Small areas within the large "dirty" areas from which the chief vecting tick and the disease have been eradicated.

A few farms in endemic areas have been efficiently fenced; dipping is energetically pursued; and the stock are confined to the fenced area. On these farms no *R. appendiculatus*, and very few other species of ticks were found after careful and long search. Although the disease occurred at one time, and is still present on adjoining lands, it has now been eradicated. The Veterinary Research Laboratory and some veterinary stations illustrate the practicability of control and eradication.

(*e*) Small areas within the larger clean areas where control of the disease has always proved difficult. From these pockets the disease repeatedly spreads into the clean area, giving rise at frequent intervals to small outbreaks which are, normally, easy to stamp out, but which in particularly wet years tend to assume more serious dimensions. These are "clean" areas where dipping is desultorily carried out, and where the movement of stock is more or less controlled on unfenced, or partially fenced, land.

Relaxation of dipping measures, the utilisation of grazing outside the controlled area during drought periods and illicit movements of stock account largely for these sporadic outbreaks.

It must be borne in mind that there is no hard and fast rule as to what constitutes "clean" conditions on the one hand and "dirty" conditions on the other. Certain of these clean areas are more suited to the development of *R. appendiculatus* than others, and in such areas there is always the possibility that prolonged relaxation of control measures will lead to an infestation that is permanent or, at all events, extremely difficult to eradicate.

Outbreaks of East Coast fever have occurred apparently in the absence of *R. appendiculatus*, and in several instances the characters of the disease have been unusual. Transmission experiments with other species of ticks are being carried out. *R. neavei* may possibly be responsible for some outbreaks in the Masai Reserve.

Detailed reports of field investigations have already been published in departmental bulletins.

Laboratory experiments on the biology of various species of ticks have been, and are being, carried out on the basis of observations made in the field. These researches will be extended as part of a programme of work by the team at the laboratory.

Trypanosomiasis.—A strain of *T. congolense* has been established by Mr. Danks at the laboratory. The strain infects rabbits and rats, parasites appearing in the blood sixteen days after inoculation. Guinea pigs failed to react to direct inoculation of infected mules' blood, but were successfully infected with the sixth passage of the trypanosomes in rabbits' blood.

Rabbits are now used to maintain this strain of *T. congolense*, since it has been found that they react consistently. A strain of *T. evansi*, obtained from camels at Isiolo, has also been established in rabbits and dogs. A striking feature of the infection with this species in dogs is the constant occurrence of keratitis, mentioned by Carmichael in Uganda as characteristic of *T. congolense* infection of this host. In our experience this symptom was less frequently seen in *T. congolense* infections of dogs than in *T. evansi* infections.

Diagnostic Tests.—A simple diagnostic test, similar to the mercuric chloride test used in *T. evansi* infections of camels, but applicable to the diagnosis of *T. congolense* infections in cattle would be of the greatest value to veterinary administration in tropical Africa. In an examination by Mr. Danks of the possibility of elaborating such a test various salts of heavy metals have been used in dilutions ranging from 1 : 1,000 to 1 : 80,000. Mercuric chloride, lead acetate, silver nitrate, antimony tartrate and stannous chloride have all been tested, both with negative and positive sera from bovines, dogs, rabbits, guinea pigs and rats. In no instance has there been sufficient differentiation between the respective positive and negative tests to suggest that the technique has any potential value in the diagnosis of *T. congolense* infections.

Complement fixation tests were tried, using as antigen washed tryanosomes from rabbits' blood, but without success. An antigen that gave more promising results was prepared from the spleen of infected dogs, and further work will be carried out when opportunity permits.

Protein estimations of normal and *T. congolense* infected blood are being made to ascertain if there is any variation in the relative amounts of the different fractions, such as is known to occur in *T. evansi* infection of camels and in Kala-azar.

Experiments on the treatment of *T. congolense* infections with various arsenic and antimony compounds will also be undertaken in the near future.

The distribution of the different trypanosomes in game and in domestic animals in Kenya Colony is of practical importance, and it is hoped that the survey already started will be continued throughout next year with the aid of the Game Department, district veterinary officers, and others.

Tsetse Flies.—Dr. Lewis has added considerably to our knowledge of the distribution of tsetse flies that attack domestic stock in the Colony, and has, in a few instances, been able to advise successful measures of control. It is necessary only to reiterate that much remains to be done in this field. The necessary enquiries into the extent of permanent fly-belts, and tsetse fly dispersal areas demand the provision of a team of fly boys, and a small staff of natives is being trained for this work under the entomologist.

An important discovery during the survey has been that *Glossina swynnertoni* occurs over a large area of the Masai Reserve adjoining Tanganyika Territory. This species inhabits a portion of the Narok administrative district, and is found in conjunction with *G. pallidipes*, and, to a less extent, with *G. fuscipleuris*.

G. swynnertoni is capable of transmitting the trypanosomes both of man and domestic animals.

An encouraging aspect of the tsetse fly problem is the material assistance given in the form of a grant from the Colonial Development Fund for experimental work on *G. pallidipes*. The investigations, which are to be carried out in the Lambwe Valley, South Kavirondo, will add to our knowledge of the bionomics of a tsetse widely spread in Kenya Colony.

DISEASES OF POULTRY.

Fowl Typhoid.—A detailed study of various aspects of this disease has been in progress for the last three years and the results are now in the press. Judging by the number of cases that are forwarded to Kabete each year, fowl typhoid is still the most frequent cause of heavy mortality of fowls and turkeys in Kenya.

Experience has shown that reliance cannot be placed on the agglutination test for the detection of immune or carrier birds. Unlike pullorum disease, therefore, fowl typhoid cannot be controlled by the elimination of reacting birds. The Kabete vaccine, which consists of living attenuated organisms, gives excellent results when used regularly as a prophylactic. Hygenic measures must also be adopted, when the vaccine is used, to control outbreaks. In laboratory experiments killed vaccines do not afford so good a protection as vaccines containing living, attenuated bacilli.

Epizootiological evidence in this country strongly suggests that pullorum disease and fowl typhoid are two distinct conditions.

Pullorum Disease.—It is unfortunately necessary to report the existence of this disease in Kenya. In November, 1932, two lots of hen-hatched chicks were received at the laboratory from which organisms were isolated that resembled anaerogenic strains of *B. pullorum* in their fermenting powers. In view of the small mortality in each of these lots, and the fact that death did not occur until the fourteenth day, some doubt was felt whether that this organism was actually *B. pullorum*. The organism was, however, found to be fully pathogenic for chicks both on feeding and on inoculation and, in every case, was recovered in pure culture from the liver of the experimental birds.

Towards the end of December a batch of dead chicks was received from the Molo district with a typical history of pullorum disease. These chicks were hatched in an incubator, the owner reporting that she had lost an increasing percentage of chicks with each batch until, of the batch from which specimens were submitted, all had died. An agglutination test of the breeding stock showed that a large percentage were infected, including a white leghorn cock and pullets that had been imported from England. A number of reacting hens were sent to Kabete, and *B. pullorum* was isolated from the ovaries. The organism again proved to be an anaerogenic strain.

Leukaemia.—A condition that in its pathology resembles fowl leukatemia has been responsible for some mortality in various parts of the Colony. A filtrable virus, transmissible by inoculation, is reputed to cause this disease, but at this laboratory all attempts to transmit the local disease with blood and liver or spleen emulsions have been unsuccessful. No specific treatment or prophylactic measures can as yet be suggested.

Roup.—Many cases of the particular form of this disease in which there is a prominent swelling of the infraorbital sinus have been under observation at the laboratory. The condition, which is fairly common both in fowls and turkeys, is apparently not due to infection with the virus of fowl-pox. Cultures made from fluid or from the cheesy exudate withdrawn from the swellings under the eyes have in most cases remained sterile. In one instance pure cultures were recovered of a haemophillic bacillus, probably identical with that described by de Bleck and others from causes of contagious coryza in birds. Further work will be undertaken on this condition when material is available.

Botulism—Limber-neck of Ducks and Geese.—A small outbreak of what was diagnosed clinically as botulism occurred a few miles from Nairobi. After the death of about forty birds in one day, the owner slaughtered the remainder, many of which were showing typical symptoms of limber-neck, and dressed them for the table. We were unable to recover cultures of *C. botulinus* from any of the birds examined at the laboratory and we were, unfortunately, quite unprepared to carry out serological diagnosis, since this is the first time the condition has been seen in Kenya. Clinically, the course in two ducks and one goose that recovered was quite typical, leaving no room for doubt as to the correct diagnosis; and it was possible for the Medical Officer of Health to seize the birds that had been dressed for table before they could be exposed for public sale.

General.

Myiasis.—Reference was made to this subject in the last annual report. It appears, however, that many farmers believe that *Chrysomyia bezziana*, the "screw-worm fly" does not exist in the Colony. In a publication which unfortunately was not widely distributed, Dr. Lewis pointed out that this species of fly was commonly found in the tissues of animals. Numerous maggots of this species have been collected from wounds and sores in cattle and in sheep.

On several occasions questions have been addressed to the Entomologist about a fly that lays a maggot beneath the skin of animals and humans, and causes a painful blister or boil. Frequently this is called the "mango-fly", obviously a misnomer for *Cordylobia anthopophaga*, the "tumbu fly of Africa", received the name "Maungu fly" because of its abundance at Maungu in the early days of railway construction in the Colony. This fly does not lay eggs beneath the skin, but on ground or bedding contaminated by excreta of animals, or on cloth soiled with excrement or human perspiration. An animal or man exposed to contact with infested material may be attacked by larvae hatched from the eggs.

Sterility.—During the year attempts were made to transmit the catarrhal condition of the vagina of cows, to which reference has previously been made. The attempts so far have been unsuccessful and attention has now been turned to the changes that are frequently observed in these outbreaks in the testicles of bulls. This investigation will be continued, and it is hoped during 1934 to enlarge the scope of reseaches on sterility by an investigation of the effect of some nutritional factors.

Publications.

1933—Daubney, R. and Hudson, J. R., " Rift Valley Fever," The East African Medical Journal, Vol. X, No. 1, pp. 2–19.

1933—Daubney, R., " Trichostrongylid Nematodes from Sheep in Kenya, Parasitology, Vol. 25, No. 2, pp. 224–241.

1933—Lewis, E. A., " Observations on some Diptera and Myiasis in Kenya Colony," Bulletin of Entomological Research, Vol. 24, Part 2, pp. 265–269.

R. J. DAUBNEY,
Chief Veterinary Research Officer.

(C) EXPERIMENTAL AND INVESTIGATIONAL WORK AT GOVERNMENT FARM, NAIVASHA

(In collaboration with the Rowett Research Institute, Aberdeen)

OBITUARY.

His Excellency the Acting Governor regrets to announce the death of Mr. H. M. Gunn, M.A., B.Sc., B.Sc. (Agric.), which occurred in Nairobi on October 22nd, 1933, as the result of a motor accident.

The late Mr. Gunn was attached to the staff of the Department of Agriculture as Manager of the Government Farm, Naivasha. He was a keen and highly qualified scientific worker and first came to Kenya in September, 1926, in connection with the local pasture experiments undertaken by the Rowett Research Institute, Aberdeen, on behalf of the Imperial Committee of Civil Research, in which capacity he rendered very valuable service to both Government and the farming community.

He possessed a charming personality and through his untimely death he will be greatly missed by a wide circle of friends.

The Naivasha station has been established as an experimental centre for the investigation of live stock problems, with the particular object of ascertaining by means of practical experiment and costings the direction in which animal husbandry methods practised in the temperate countries, such as the United Kingdom, need to be modified to suit tropical conditions, such as those of Kenya. The year 1933 has proved to be the most difficult in the history of the station, with reference to the carrying out of these objects.

In common with all purely pastoral farms the station experienced a decrease in revenue owing to the continued fall in the prices obtained for animal products, but the position was aggravated by drought conditions which persisted throughout the entire year. The farm grazing at the beginning of the year was showing substantial damage as the result of the previous two years of locust infestations, and at no time during the year was the rainfall sufficient to enable the grass to make any permanent recovery. The rainfall for the year was seven inches below normal, only 13.04 inches being recorded. Had the grass been in good heart even this low rainfall would probably have provided sufficient growth to prevent definite manifestations of malnutrition in the farm stock, but the cumulative effects of drought and locust infestations from previous years were responsible for a heavier death rate than normal. The total death rate for cows, weaners, calves and steers (mainly attributable to poverty) was 17.2 per cent. It is to be hoped that the rainfall in 1934 will be on a sufficiently generous scale to permit the complete recovery of pastures.

A further complication of the year's working was the fact that the farm remained in quarantine for East Coast fever until the 6th of August, so that until that date use could not be made of the Lakeside shamba which lies across a main road. During 1933 therefore the farm laboured under two disabilities not common to other pastoral farms, and as a result the difficulties of management were greatly increased in what was already, in many other respects, a difficult year for all pastoralists.

Butter fat prices continued to decline and an average payout of 73 cents per lb. by the Kenya Co-operative Creamery resulted in an average receipt of 71.88 cents per lb. by the farm, as compared with 78 cents in 1932.

Slaughter stock were difficult to sell and prices reached a new low level.

Wool sales showed a distinct improvement over the previous year, amounts of 50 and 64 cents per lb. being received as compared with 31 and 35 cents in 1932.

Milk Production.—The average number of cows per month on the farm was 115, the highest and lowest numbers being 127 and 101 respectively.

The average number of cows in milk throughout the year was 57, the maximum being 75 and the minimum number 40. The total cow days numbered 19,226 or only 66.8 per cent of the possible total, taking a lactation period of 250 days.

Grazing conditions, for reasons already outlined, were most unfavourable to milk production, and at several periods of the year the pasture was not even sufficient for maintenance requirements; consequently the expenditure on supplementary foodstuffs was high.

The total amount of milk produced was 20,808 gallons and the output of butter fat from 18,607 gallons sold was 6,518.8 lb., giving an average percentage of butter fat of 5.5

per cent. An average yield of 180 gallons per cow was obtained at a total cost of 57.2 cents per gallon. Explanatory details of milk production costs appears in Appendix I.

The birth rate in the herd for the year was 78 per cent.

Calves.—All calves were hand-reared, with the exception of three pairs suckled by foster mothers. The complete lack of rough grass which could have been cut for bedding resulted in the calves sleeping on plain concrete and in consequence live-weight gains were not so good. No cases of Bacillary Necrosis occurred and very few cases of scour. The outbreak of foot and mouth disease in August, however, accounted for nine deaths out of the total of twenty-five attributable to disease and related causes, including general debility from birth.

Fifteen bull calves were sold as vealers and sixteen bull calves were fed to the pigs within one week of birth.

The method of hand-raising, outlined in previous reports, was continued, but the skim milk was continued, whenever it was available, beyond the sixth month, to supplement the poor grazing.

Steers.—The rearing of grade bull calves for slaughter purposes was discontinued. During 1933 only thirteen steers out of a mob of eighty-six were sold. These gave a net return of Sh. 70/30 each on the farm. Heavier sales could have been made if more steers had been in a marketable condition. An expenditure of Sh. 4/19 per head for the year, excluding any charge for grazing, was incurred on the herd of steers.

Sheep.—The exceptionally dry climatic conditions suited the flocks and they maintained their condition well. The wool clip was heavier than in 1932, and owing to a sharp rise in the market, the wool gave a substantially better return. Following practice in 1932, the clip was divided into two approximately equal lots, consigned to England and France respectively. The net receipt position was similar to that of 1932, since the English consignment again realized less than the French, the figures being 50.02 cents and 64.1 cents, as compared with 31.5 cents and 35.1 cents in 1932. The account sales for each consignment are summarized in Appendix II.

The four Merino Rams imported in 1932 from South Africa have proved very satisfactory in use and it is proposed to make a similar importation in 1934.

The estimated profit on the Merino flock, in which there were in December 974 sheep over twelve months old, amounted to Sh. 4,475/86 for 1933, making no charge for grazing.

The flock increased by 224 adult sheep in 1933.

The work on native sheep is noted under the Experimental Section of this report.

Pigs.—For reasons which are dealt with in the Experimental Section, no specific work was done in the pig herd during the year.

The Large White-Large Black Cross is still produced, and is probably the best suited cross for bacon purposes in this Colony. The difficulties experienced in the herd during 1933 confirm the view that the farm is not entirely suited to pig production. Owing to the presence of swine fever in this area the herd has to be confined to a relatively small grassless boma. The females are thus unable to get the exercise that experience has shown such breeding-stock require. In addition, the absence of grazing has a deleterious effect on the growing stock. In a year of good rains it is possible to grow an adequate supply of green food, but in a drought year such food is available in very limited quantities and in consequence the growth rates are slower and the general efficiency of the herd suffers. It is felt that the farm might support a small pure bred herd of Large White pigs provided the numbers were kept well within the limits imposed by restricted accommodation and a limited green food supply.

Careful attention to herding and the erection of a papyrus shade have overcome the incidence of sun-scald mentioned in the 1932 report and this factor should not be regarded as a bar to the keeping of pigs of the Large White breed.

Surplus breeding stock, comprising three Large White boars, three Large White gilts, two Large Black boars and four Large Black gilts, were sold to pig breeders; and in addition, twenty-one bacon pigs were sent to the factory.

Owing to the especially adverse factors operating in 1933 the loss on the pig herd amounted to Sh. 1,215/72.

Lumbwa Cows.—The milk yields of this small herd were again recorded but results were no better than in the previous year. No one cow exceeded a daily yield of 5 lb. while the lactation periods were all under six weeks. As stated in the 1932 report, these cows are all poor specimens of their breed, and while it was expected that they would improve under management similar in every way to that employed with the grade cattle, it is to be doubted whether the inbred disqualities can now be overcome, since the cattle are mature and set.

A Lumbwa bull reared on the farm is now running with the herd and it is confidently expected that in future a much better class of animal will be bred, which will show a good response to improved management and conditions, but the view expressed in the 1932 report cannot be too strongly emphasized, viz. "that in attempting to utilize the native cow as a dairy animal, only animals which have been secured as the result of rigorous selection should be employed".

Agriculture.—The vital necessity of providing some fodder crops for the stock was not lost sight of, but owing to the complete lack of rain all efforts in this connection were wasted. Eighteen acres of maize were planted at the end of April when rain conditions looked promising, but lack of rain in June and July led to the failure of the crop, and no further data on the feeding of ensilage could be obtained,

Four acres of lucerne were planted in May in the Lakeside shamba, but in spite of good germination, the lack of rain retarded growth and a first cutting was not obtained until August; it has, however, been possible to cut the lucerne at six weekly intervals. This excellent result stimulated further efforts to establish lucerne and the preliminary preparation of twenty acres of land was begun.

Pasture Investigations.—The work under this heading was suspended during the year owing to climatic conditions, but on the advent of rain the work can be continued, and steps to this end have been taken.

General.

Staff.—The staff position during the year was rendered most difficult by the retirement after leave of Mr. R. W. Farquhar, and the absence on leave of Mr. H. M. Gunn from April to October.

Mr. K. S. Smith was appointed to assist Mr. Gunn as from 16th January, and has continued in the capacity of assistant manager throughout the year.

During the absence of Mr. Gunn the duties of manager were discharged by officers of the Department of Agriculture, firstly by Mr. T. Y. Watson, from April to the end of June, and thereafter by Mr. W. D. D. Jardine, who took over this work in addition to his normal duties as Animal Husbandry Officer.

The sudden death of Mr. Gunn, immediately on his return from leave in October further complicated a position that was already difficult.

During 1933 the efforts of the staff were primarily directed to maintaining the flocks and herds in a healthy condition, and during the months of June and July in particular to keeping the stock alive. In consequence the purely experimental side of the work had to take a subsidiary place. In this connection it must be remembered that the farm has always been run on the lines of a commercial undertaking, and is expected to pay its own way. But the financial aspect of the farm operations apart, it would not have been possible to obtain the foodstuffs and fodder crops necessary for the carrying out of the experiments outlined in the provisional programme and great difficulties were experienced in obtaining sufficient hay and lucerne to keep the stock in a healthy condition. It is estimated that eighteen of the twenty-six cow deaths during the year were the direct result of malnutrition due to poverty conditions. Had it been possible to obtain more bulk foods during June and July many of the twenty-six deaths amongst the old cows could no doubt have been averted.

Financial.

At the close of a period fraught with difficulties, it can be noted with some measure of relief that the cash position was poorer by only £123/10/0; had it not been for the great improvement in the receipts from wool the position would of course have been much worse. The advisability of having mixed stock on the farm is thus strongly supported.

Experimental.

Supplementary Feeding of Dairy Cows for Milk Production.—Since the farm is in a low rainfall area (only exceptional years produce over twenty inches of rain), supplementary feeding of the milk herd should be a matter of normal routine. In past years some preliminary work has been carried out on this subject, particularly in regard to the feeding of maize silage and green fodder crops in addition to the concentrate ration. Certain tests started in 1932 were continued into 1933 as far as the green food available permitted. New tests could not be undertaken owing to failure, for the reason already stated, of the 1933 crops.

Test I—Green Forage.—A test of the effects of supplementary green forage on milk production was commenced on 15th July, 1932, and continued until 31st January, 1935. Two groups of cows, seven in each, were treated as follows: Both groups received concentrates at the rate of 2 lb. for each gallon of milk produced. The concentrate ration was simsim cake two parts, wheat bran one part.

Group II was fed 10 lb. kale and 10 lb. green lucerne daily for the first six weeks and 20 lb. green lucerne daily for the remaining five months.

Group I, the control group, received no supplementary green, but the concentrate ration of this group had to be doubled in October, 1932, and was continued at that high level to the end of the test. This increase was rendered necessary as the grazing, owing to locust depredations and drought, could barely supply maintenance requirements.

Total production per cow during 6½ months (200 days) experimental period :—

Group I, 3,071 lb. Group II, 3,989 lb.

Difference in favour of Group II, 981 lb. or approximately ½ gallon of milk per cow per day.

Test II.—To compare the values of maize silage and green lucerne as part of the production ration. For purposes of comparison, 30 lb. silage was considered the equivalent of 20 lb. green lucerne.

Owing to the small amount of silage available the test was only carried on for six weeks with five cows in each group.

Group I: 20 lb. lucerne plus 2 lb. concentrate for each gallon of milk produced.

Group II: 30 lb. silage plus concentrate as above.

	PRE-PERIOD	EXPERIMENTAL PERIOD (15-2-33—31-8-33)	
	Average Daily Yield	Average Daily Yield	Percentage Decrease
	Lb.	*Lb.*	*Per cent*
GROUP I	79·4	61·8	22·2
GROUP II	91·2	72·6	20·4

While this result is not significant it may be noted that the total milk yield on the farm dropped 40 per cent during March so that the beneficial effect of supplementary feeding was clearly demonstrated.

Calves.—The calf-rearing methods outlined in previous reports were continued to the age of six months. After this the calves were not put on to any particular test or specific feeding. As and when skim milk was available they received extra ration beyond this age, and when no skim milk was available they received concentrates, the amount varying from 1 lb. to 3 lb. according to prevailing conditions. It was felt that as the grazing conditions varied so much and in general were so poor throughout the year, no useful purpose would be served by submitting groups of calves to a feeding test, but the results obtained in a mineral mixture trial (detailed below) if compared with the foster-mothered calves seem to indicate that the management had proved beneficial; and certainly a better live weight increase was obtained than that recorded in the previous year's test calves.

Test I.—To compare cattle salt and Magadi soda as mineral licks.

The weights of two groups of similarly aged calves (four in each group) were recorded from 1st April to 31st December. The mineral mixtures were offered to the calves as soon as they commenced to eat concentrates. Minerals amounting to 5 per cent of the concentrated rations were used.

Group I: Cattle salt and bone meal in equal proportions.

Group II: Magadi soda and bone meal in equal proportions.

	GROUP I	GROUP II
	Lb.	*Lb.*
Average initial weight (1–4–33) ..	109·2	105·0
Average weight at weaning (31-12-33)	462·25	427·75
Increase in 276 days	353·05	322·75
Average gain per day	1·24	1·17

This result is a little difficult to interpret. The calves on Magadi soda mixture never relished the soda part and would deliberately avoid what soda they could. When the soda was crushed very fine in order to get a more even mixture the calves took much longer to eat their concentrates and the opinion was formed that had it not been for the presence of cake in the concentrates the calves would have left the mixture alone.

It will be noted that the final weights and the average gains show little difference, and it is possible that the calves made what use they needed of the natural earth licks on the farm, correcting in this way the balance of their mineral intake. Since the grazing position was so very complicated all the year, steps could not be taken to ensure that the calves did not have access to the earth licks; but it was noticeable that during a time when the calves were kept in small paddocks with no earth licks the bone meal and salt group made the best live weight gains.

Suckling Calves.—During the year three cows known to be low producers were given two calves each and the live weights from these three pairs of calves were recorded.

AVERAGE WEIGHTS

At Birth	At 6 months	At 9 months	At weaning 303 days
Lb.	*Lb.*	*Lb.*	*Lb.*
54	225	271	288

Average gain per day—0·77 lb.

Note.—Considering the severity of the adverse conditions throughout the year, this average gain of .77 lb. can be regarded as very satisfactory. Up to the age of six months the average gain was .96 lb. per day and it was hoped to maintain this figure, but the conditions towards the end of the year made this impossible. These calves received no supplementary feeding.

This system of calf-rearing is very applicable to the majority of ranch-dairy farms and is worthy of wider application. The limited use made of the system during 1933 was due to the fact that only eight of the seventeen foster mothers used in 1932 calved during 1933; coupled with the vital necessity of keeping the cream sales at as high a figure as possible.

Sheep.

Test I.—A feeding test with lambs weaned in June 1932 was commenced in July 1932, and carried on until March 1933, when the lambs were shorn and their fleece weights recorded. The object of this test as set out in the 1932 report—page 9—was to define whether it is an economical proposition to feed weaner lambs up to twelve months old, i.e. during the period when least progress is made, as shown by records of the rate of growth of young stock on the farm.

Three pens of lambs with forty in each pen were used.

	GROUP I		GROUP II		GROUP III	
	Grazing Alone		Salt and Bone Meal		Concentrates and Mineral Mixture	
	Wethers	Ewes	Wethers	Ewes	Wethers	Ewes
Average increase in weight at 31–12–32	3·9	4·1	5·0	5·4	10·1	9·1
Average increase in weight from 31-12-32 to 31–3–33 ..	18·7	14·5	16·0	18·2	18·3	14·3
Total increase from weaning to shearing	22·6	18·6	21·0	21·6	28·4	23·4
Cost of feeding per head to 31–12–32..	—	—	50 cts.	—	Sh. 1/42	
Further cost to 31-3-33	—	—	13 cts.	—	58 cts.	
Total cost of feeding..	—	—	63 cts.	—	Sh. 2	

It would appear that the advantage gained soon after weaning by Group III (protein and mineral feeding) was not retained after twelve months of age. It must be remembered that the grazing from January to March, 1933, was well below normal, and it might be expected that in normal times the differences in weights would have been even less noticeable.

Fleeces.—Neither in quality or weight was there any appreciable difference in the fleece weights of the three groups.

GROUP I		GROUP II		GROUP III	
Wethers	Ewes	Wethers	Ewes	Wethers	Ewes
Lb. 5·6	*Lb.* 5·3	*Lb.* 5·2	*Lb.* 5·3	*Lb.* 5·3	*Lb.* 5·5

Test II—To compare cattle salt and Magadi soda as mineral licks.—Three groups of lambs (twenty-five in each group) weaned in December, 1932, were used for this test, which was commenced in April and terminated in December, when the lambs were shorn and the fleece weights recorded. The three groups were grazed together during the day but were penned separately at nights, when the different mineral mixtures were fed to the sheep *ad lib.*

Group I : No minerals.

Group II : Salt and bone meal in equal parts.

Group III : Magadi soda and bone meal in equal parts.

	GROUP I		GROUP II		GROUP III	
	Wethers	Ewes	Wethers	Ewes	Wethers	Ewes
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Initial live weights at 1–4–33	63·9	62·0	64·0	61·3	61·0	61·1
Weight at 1–12–33 ..	71·3	72·3	74·5	72·4	71·4	74·3
Average increase ..	7·4	10·3	10·5	11·1	10·4	13·2
Fleece weights ..	5·0	5·0	5·3	5·3	5·4	5·1

On the figures shown the Magadi soda compares very favourably with salt, although, owing to the farm being rich in earth licks from which it was impossible to keep the sheep, these figures may be misleading. A comparison should be made with figures obtained in parts of the country where there is a definite mineral deficiency.

Test III.—In order to observe the weights attained by cross-bred sheep, two groups of Persian × Masai sheep and one group of half-bred Suffolk ex-Masai sheep were weighed monthly (fifteen sheep in each group).

	Average Birth Weights		Weight at 28-12-33 (age (i) 19 mths. (ii) 18 mths. (iii) 23 mths.)	
Half-bred Suffolk–Masai	6·6	6·9	92·0	100·7 (i)
Persian—Masai	5·8	6·3	90·0	93·1 (ii)
Persian—Masai	5·9	6·5	97·0	116·0 (iii)

Grazing conditions throughout the year were not favourable to uniform increases in weights, during certain months a decrease in weight was recorded.

As stated in the report for 1932 the object is to breed a uniform Masai flock, since these sheep as shown by the figures respond very readily to good grazing and management, attaining a weight at eighteen months of over 90 lb. from an average birth weight of 6 lb.

The small flock of pure bred Black Headed Persians is being kept intact and ram sales from this flock should develop.

Pigs.—Numerous difficulties were experienced during the year. To begin with the supply of rough grass for bedding failed in April and the herd was obliged to sleep on plain concrete floors, a practice open to serious objections in a climate with such a big variation between day and night temperatures. Sleeping boards and sacks were introduced to correct this, but owing to ignorance or dislike on the part of the pigs they did not prove a great success.

In consequence of the trying climatic and housing conditions, several sows farrowed down with udder troubles and were unable to rear their litters. Attempts to bring up young pigs by feeding on the bottle were not successful.

Foot and mouth disease played havoc with the pigs in August and it was most unfortunate that this coincided with the farrowing period : three litters were either born dead or died immediately from food (milk) trouble.

The foodstuff situation was very difficult throughout the year. Supplies were irregular and as the farm has only poor storage accommodation, it is dependent on month to month deliveries. In normal years this works reasonably satisfactorily, but in periods of food shortage such as 1933 the system breaks down.

In view of all these factors it was decided not to conduct any experimental work on the pigs but to confine attention to the costings, and it is not surprising to find that a loss of Sh. 1,215/72 was incurred in 1933.

It is of interest to note that in July it was found necessary to barter twelve weaner pigs for lucerne hay. There was not enough skim milk to do the weaners properly and there was an immediate necessity for obtaining some bulky foodstuffs for the cows.

Conclusion.

In presenting this report a brief reference might be made to the loss which the service sustained in the untimely and sudden death of Mr. H. M. Gunn. In Mr. Gunn's obituary notice published by His Excellency the Governor in the Official Gazette, reference is made to the value of Mr. Gunn's services to research on matters connected with animal husbandry, and to the high personal esteem in which he was held by all who knew him. It is lamentable that such an experienced and enthusiastic worker should be lost to science at a comparatively early stage in his career.

It is fitting that an appreciation be made of the services of Mr. K. S. Smith, who, as assistant manager during a prolonged period of stress and under varying managerships, preserved the continuity of the farming operations, carried out the detailed work of costing these operations, and by close attention to details and sound co-operation made the compilation of this report possible.

W. D. D. JARDINE,
Animal Husbandry Officer.

APPENDIX I

MILK PRODUCTION: SUMMARY OF COSTS.

Number of cows in herd : 115.

Total production : 20,898.8 gallons.

Average milk yield per cow : 180 gallons.

Amount of milk separated for butter fat : 18,607 gallons.

Total butter fat sold : 6,518.8 lb.

Charges against the herd.

	Cents per gallon
Purchased food	19.5
Home grown food	1.6
Labour	6.4
Depreciation	23.3
Bulls, dipping, sundries, etc....	6.4
Total ...	57.2

	Sh.	*cts.*
Total revenue from butter fat sold from 18,607 gallons of milk separated	4,541	81
Return per gallon of milk separated		24.4
Revenue loss per gallon of milk sepaarted ...		32.8

N.B.—The above return does not include the separated milk fed to calves and pigs on the farm, amounting to 16,838 gallons, which is charged to the calves and pigs at 10 cents per gallon, and raises the return per gallon to 33.4 cents and lowers the loss to 23.8 cents per gallon, which is covered by the depreciation figure of 23.3 cents.

An indication of the effects of locusts and drought will be gathered from a comparison of the above figures with those of 1932, when the cost of production of milk per gallon was only 17 cents, of which the charge against supplementary feeding amounted to 8 cents, labour charges to 4 cents, the remaining 5 cents covering the depreciation of the herd, maintenance of bulls, dipping and dairy charges. The average yield per cow being 294 gallons.

The high cost of purchased foods, and the heavy depreciation of the herd due to a high death rate, coupled with a greatly reduced yield per cow puts the production of milk in a very uneconomical position for the year 1933.

APPENDIX II

Marketing of Wool, 1933.

Two consignments of wool, divided as far as practicable into consignments of equal qualities, were exported to the London and Continental markets respectively in September, 1933.

SUMMARY OF ACCOUNT SALES

I.—Consignment Sold in London, 12 Bales=4,253 lb. net.

	Sh. cts.		*Sh. cts.*
To Gross Receipts ..	2,779 66	By Freight to Coast ..	131 00
,, Freight Rebate ..	18 50	,, Shipping Charges at Coast	179 04
		,, Ocean Freight ..	203 50
		,, Consolidated Rate ..	108 00
		,, Brokerage, Commissions	49 25
		,, Balance	2,127 37
Sh.	2,798 16	*Sh.*	2,798 16

To Balance brought forward—Being net return .. 2,127 37

Net Return f.o.r. Naivasha per lb.=50·02 cents.

II.—Consignment Sold in France, 9 Bales=3,153 lb. net.

	Sh. cts.		*Sh. cts.*
To Gross Receipts ..	2,993 00	By Freight to Coast ..	90 00
,, Freight Rebate ..	13 82	,, Shipping Charges at Coast	138 52
		,, Ocean freight to Antwerp ..	305 00
		,, Sorting, Washing, etc.	424 00
		,, Exchange, Post Charges	27 00
		,, Balance	2,022 30
Sh.	3,006 82	*Sh.*	3,006 82

To Balance brought forward—Being net return .. 2,022 30

Net Return per lb. f.o.r. Naivasha=84·1 cents.

APPENDIX III

REVENUE.

The revenue to meet current expenditure involved in the maintenance of the farm is derived from the sale of produce, viz. butter fat, wool and live stock. A summary of the output for 1933 and of the cash return is given below.

Amount Sold	lb.		Sh. cts.
Butter-fat	6,518·8	Cash Return	4,541 81
Wool	7,406	Cash Return, net ..	4,149 67

STOCK SALES

BREEDING STOCK	Sh. cts.	SLAUGHTER STOCK	Sh. cts.
Cattle—		Cattle—	
Bulls (2)	520 00	Steers (13)	1,043 60
Calf (1)	100 00	Calves (20)	130 00
Pigs—		Pigs—	
Boars (5)	480 00	Weaners (12).. ..	175 00
Gilts (8)	985 00	Baconers (18) ..	1,218 02
Service Fees	40 00	Porkers (3)	66 40
Native Sheep—		Native Sheep—	
5 Rams and 1 Ewe ..	154 00	Wedders (7)	102 00
3 Lambs	46 00		
Grade Merino Flock—		Grade Merino Flock—	
7 Hoggests and 1 Ewe	360 00	Wedders (7) ..	80 00
Sh.	2,635 00	Sh.	2,815 02

TOTAL PROCEEDS FROM ABOVE SOURCES IN 1933

	Sh. cts.
Butter-fat	4,541 81
Wool	4,149 67
Breeding Stock	2,635 00
Slaughter Stock	2,815 02
Sh.	14,141 50

APPENDIX IV

VALUATION OF LIVE STOCK AND EQUIPMENT, DECEMBER 31st, 1933.

	Sh.	cts.	Sh.	cts.
I.—Live Stock on Hand—				
Cattle	41,895	00		
Sheep	22,215	00		
Pigs	1,520	00		
Horses	400	00		
			66,030	00
II.—Implements and Equipment			4,215	50
III.—Sundry Stores			80	95
IV.—Foodstuffs on Hand			350	29
V.—11 Bales of Wool @ £12 a bale			2,640	00
Total Valuation Sh.			73,316	74

FARM OPERATING ACCOUNT, 1933

Current Account

1933 Receipts	Sh. cts.	1933 Expenditure	Sh. cts.
1st January, 1933		Jan. 1st—Dec. 31st	
To Balance at Bank	11,371 14	By Sundry Payments	17,919 66
,, Cash in Hand	38 82	,, Balance at Bank	8,443 96
Jan. 1st—Dec. 31st		,, Cash in Hand	160 88
To Sundry Receipts	15,114 54		
Sh.	26,524 50	Sh.	26,524 50
1st January, 1934	Sh. cts.		
To Balance at Bank	8,443 96		
,, Cash in Hand	160 88		
Sh.	8,604 84		

FIXED DEPOSIT ACCOUNT WITH THE NATIONAL BANK OF INDIA, LIMITED

	Sh. cts.		Sh. cts.
1st January, 1933—		22nd August, 1933—	
To Balance	9,665 00	By Transfer to Current account	3 27
,, Interest on above	338 27	By Balance	10,000 00
Sh.	10,003 27	Sh.	10,003 27
1st January, 1934— To Balance on Fixed Deposit	10,000 00		

FINANCIAL SUMMARY

	Sh. cts.	*Sh. cts.*
1st JANUARY, 1933—		
Bank Balance	11,371 14	
Cash	38 82	
Deposit	9,665 00	21,074 96
31st DECEMBER, 1933—		
Bank Balance	8,443 96	
Cash	160 88	
Deposit	10,000 00	18,604 84
Cash Deficit on year's working .. *Sh.*		2,470 12

Part IV

PRINCIPAL CHANGES AND NEW APPOINTMENTS IN TECHNICAL STAFF DURING 1933

I.—ADMINISTRATION AND GENERAL.

Mr. Alex Holm, C.M.G., C.B.E., F.H.A.S., M.R.A.S.E. (Gold Med.), S.E.A.C., (Dip.Hons.), retired with effect from 1st September, 1933.

Mr. H. B. Waters, B.A. (Oxon.) assumed duty as Director on transfer from the Gold Coast on 24-12-33.

Mr. H. Wolfe, M.Sc. (Agric.), Deputy Director (Plant Industry), was Acting Director from 18-4-33 to 23-12-33.

Mr. D. L. Blunt, M.A., Assistant to Director, was appointed Director of Agriculture, Cyprus, with effect from 29-8-33.

II.—DIVISION OF PLANT INDUSTRY.

Mr. G. J. L. Burton, M.C., B.A., was Acting Deputy Director (Plant Industry), from 18-4-33 to 23-12-33.

Mr. M. D. Graham, Temporary Agricultural Officer, re-engaged 20-3-33.

Mr. R. J. Benstead, Temporary Agricultural Officer, re-engaged 1-9-33.

Mr. D. H. Cairns, Temporary Agricultural Officer, appointed 24-7-33.

Mr. A. J. Cooper, Temporary Plant Inspector, appointed 10-8-33.

Dr. H. C. James, Ph.D., B.Sc., N.D.A., N.D.D., Entomologist, appointment terminated 23-12-33

Mr. P. Booth, N.D.A., Agricultural Officer, appointment terminated, 30-11-33.

Mr. A. S. Hartley, Agricultural Officer, appointment terminated 8-11-33.

III.—DIVISION OF ANIMAL INDUSTRY.

Capt. R. C. Wheeler, M.B.E., M.R.C.V.S., Senior Veterinary Officer, appointment terminated, 21-8-33.

Capt. J. T. C. Bradshaw, M.R.C.V.S., Senior Veterinary Officer, appointment terminated, 21-7-33.

Capt. O. Dixon, M.C., M.R.C.V.S., reverted to appointment of Senior Veterinary Officer, on abolition of the post of Assistant Chief Veterinary Officer.

Capt. E. J. Mulligan, M.R.C.V.S., V.O., promoted Senior Veterinary Officer, 1-2-33.

Mr. H. E. Evans, Stock Inspector, appointment terminated 21-8-33.

Mr. J. F. A. Greig, Stock Inspector, appointment terminated, 21-8-33.

Mr. G. D. Cowen, Stock Inspector, appointment terminated, 9-12-33.

Mr. A. McDougall, Yard Foreman, appointment terminated. 21-8-33.

Mr. W. P. Langridge, Assistant Stock Inspector, resigned, 30-11-33.

STAFF LIST

As at 31st December, 1933.

A.—ADMINISTRATIVE AND GENERAL.

Director.—H. B. Waters, B.A. (Oxon.).

Agricultural Economist.—V. Liversage, B.Sc. (Lond.), M.S. (Wis.), N.D.A.

Accountant (Acting).—A. Walker.

Office Superintendent.—E. J. Kelly.

Clerks.—R. Abram, R. F. G. Palmer, J. Riddell, Mrs. M. A. Carr Hole, S. G. Sharp, J. B. Gould, Miss M. V. Ashe, A. E. Dawes, J. S. Nelson, S. Morrell, Miss A. D. P. O'Meara, A. F. Wake, A. Clough, Miss H. M. Dewar, J. S. de W. Ainsworth, P. M. Corfe.

B.—DIVISION OF PLANT INDUSTRY.

Deputy Director (Plant Industry).—H. Wolfe, M.Sc. (Agric.).

Senior Coffee Officer.—A. D. le Poer Trench.

Agricultural Officers and Experimentalists.—A. G. Bailey, M.A., D. C. Edwards, B.Sc., A. C. Maher, M.A., Dip. Agric. Sci. (Cantab.), A.I.C.T.A. (Trinidad).

Plant Inspectors.—T. L. McClelland, M.C., H. Naismith Jones, C. D. Knight, E. Cottington, A. J. Cooper.

Sub-division of Native Agriculture.

Agricultural Officers.—W. L. Watt, Cert. H.A.S. Forestry, W. G. Leckie, B.Sc., C. O. Oates, N.D.A., N. Humphrey, W. O. Sunman, B.Sc., Dip. Agric. (Wye), E. W. Gaddum, B.Sc. (Lond.), Dip. Agric. (Wye), M. H. Grieve, B.Sc., Dip. Agric. (Edin.), T. Y. Watson, B.Sc., Dip. Agric. Sci. (Cantab.), J. E. P. Booth, B.Sc., A.I.C.T.A. (Trinidad), R. E. T. Hobbs, U.D.A. (Reading), P. C. Chambers, B.A. (Cantab.), A.I.C.T.A. (Trinidad), M. D. Graham, R. J. Benstead, N.D.A., D. H. Cairns.

Senior Entomologist.—T. J. Anderson, M.A., B.Sc. (Hons. Edin.), F.Z.S., F.E.S.

Entomologists.—H. Wilkinson, A.R.C.S., F.E.S., F.L.S., R. H. Le Pelley, Ph.D., D.I.C., B.Sc. (Hons.), A.R.C.S., F.E.S., F. B. Notley, B.Sc. (Hons.).

Senior Mycologist.—J. McDonald, D.F.C., B.Sc. (Hons.), F.L.S.

Mycologist.—G. A. Thorold, B.A., A.I.C.T.A. (Trinidad).

Senior Agricultural Chemist.—V. A. Beckley, M.C., M.A., A.I.C.

Soil Chemist.—C. H. G. Jones, M.Sc.

Agricultural Officer and Experimentalist.—S. Gillett, Dip.Agric.Hons. (Wye).

Clerks.—B. A. Pickering, L. O. Johnes.

Laboratory Assistants, Learner and Junior Grades.—F. McNaughtan, B.Sc. (Edin.), R. N. Noble, F. W. Evans, L. Burton, E. C. M. Green, G. Finch.

Plant Breeding Services.

Senior Plant Breeder and Experimentalist.—G. J. L. Burton, M.C., B.A.

Plant Breeder.—R. J. Lathbury, M.A.

Agricultural Officer.—N. D. Spranger.

Laboratory Assistant (Junior).—V. Gamble.

GRADING AND INSPECTION (EXPORTS AND IMPORTS): GRAIN CONDITIONING AND COOL STORES SERVICES.

Chief Grader and Inspector and Manager, Cool Stores.—C. L. Silvester, N.D.A., N.D.D.

Grader and Inspector.—F. B. L. Butler, F.L.S.

Assistant Grader and Inspector.—E. L. Bradford.

Superintendent, Maize Conditioning Plant and Cool Stores.—D. F. Sargent.

Mechanic.—A. E. Taylor.

Clerk.—H. S. Cuthbert.

C.—DIVISION OF ANIMAL INDUSTRY.

(*a*) ADMINISTRATIVE AND EXECUTIVE DIVISIONS.

Deputy Director (Animal Industry) and Chief Veterinary Officer.—H. H. Brassey-Edwards, M.R.C.V.S.

Senior Veterinary Officers.—O. Dixon, M.C., M.R.C.V.S., E. J. Mulligan, M.R.C.V.S.

Veterinary Officers.—R. S. Little, M.R.C.V.S., D.V.S.M., R. L. Creery, M.R.C.V.S., W. G. Emerson, M.R.C.V.S., F. R. Hale, M.R.C.V.S., E. Beaumont, M.R.C.V.S., T. B. McClure, M.R.C.V.S., H. Hay-Barclay, M.R.C.V.S., D. F. Macpherson, M.R.C.V.S., W. M. McKay, M.R.C.V.S., F. W. Aston, M.R.C.V.S., D.V.S.M., R. A. Hammond, M.R.C.V.S., J. Anderson, M.R.C.V.S.

Stock Inspectors.—D. Wyatt, W. L. Lewis, G. White, L. E. Smith, T. Harris, C. B. Jolley, P. H. Poolman, J. Denwett, J. H. Ward, R. H. Cameron, F. J. O'Hara, G. L. Murray, C. G. Norman, C. D. Henderson, G. Alcock, G. W. Low.

Assistant Stock Inspectors.—J. S. Nimmo, E. W. Temple-Boreham, C. J. Hill.

(*b*) SUB-DIVISION OF VETERINARY RESEARCH.

Chief Veterinary Research Officer.—R. Daubney, M.Sc., M.R.C.V.S.

Assistant Chief Veterinary Research Officer.—Vacant.

Veterinary Research Officers.—J. R. Hudson, B.Sc., M.R.C.V.S., W. B. C. Danks, B.Sc., M.R.C.V.S., W. Fotheringham, M.R.C.V.S.

Entomologist.—A. E. Lewis, M.Sc., Ph.D.

Laboratory Superintendent (Acting).—A. J. Kemp.

Laboratory Assistants.—J. T. Schultz, H. J. Gray, J. R. McQueen, E. J. Hall, W. P. Bruce, F. Lyons, S. R. Pelling, J. Forsyth.

Overseer.—G. M. Eames, Dip. Agric. (Wye).

Clerks.—J. H. Crampton, G. W. Clochley, Miss R. M. Dennis.

Clerk-Librarian.—D. Dewar.

Mechanic.—O. Stenmark.

Storekeeper.—J. Scott.

Laboratory Student.—J. A. Edwards.

(*c*) ANIMAL HUSBANDRY.

Animal Husbandry Officer.—W. D. D. Jardine, B.Sc. (Edin.), N.D.A. N.D.D. (Hons.).

Instructors in Stock.—J. Anderson, A. Lambie, N.D.A., H. C. W. Guy, C. G. Bishop.

KENYA RAINFALL 1933

	Total Rainfall	Average Rainfall	No. of Years	Excess	Deficit
	Inches	*Inches*		*Inches*	*Inches*
Lamu	23·73	35·69	27	—	11·96
Malindi	31·94	40·11	39	—	8·17
Kwale	32·14	38·16	22	—	6·02
Teita, Voi	15·86	21·31	22	—	5·45
Kitui	50·68	40·34	29	10·34	—
Machakos	32·90	36·87	38	—	3·97
Nairobi	21·33	36·89	16	—	15·56
Kiambu	32·11	41·75	25	—	9·64
Fort Hall	34·86	46·11	32	—	11·25
Embu	33·77	41·78	25	—	8·01
Meru	47·00	54·18	20	—	7·18
Nyeri	35·80	37·35	29	—	1·55
Naivasha	20·99	28·92	29	—	7·93
Laikipia, Rumuruti	21·24	28·31	21	—	7·07
Nakuru	27·64	36·70	24	—	9·06
Ravine	30·87	44·32	30	—	13·45
Nandi-Kapsabet	45·12	63·24	27	—	18·12
Uasin Gishu, Eldoret	30·31	42·98	2	—	12·67
Trans-Nzoia, Kitale	39·47	45·31	12	—	5·84
Kisumu	41·95	44·90	30	—	2·95
Kakamega	66·80	78·38	12	—	11·58
Kisii	54·07	68·71	22	—	14·64
Lumbwa	28·62	47·71	28	—	19·09
Kericho	64·45	71·30	28	—	6·85

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